Southern California's Computer Magazine

Oct. 12, 1992 • #101

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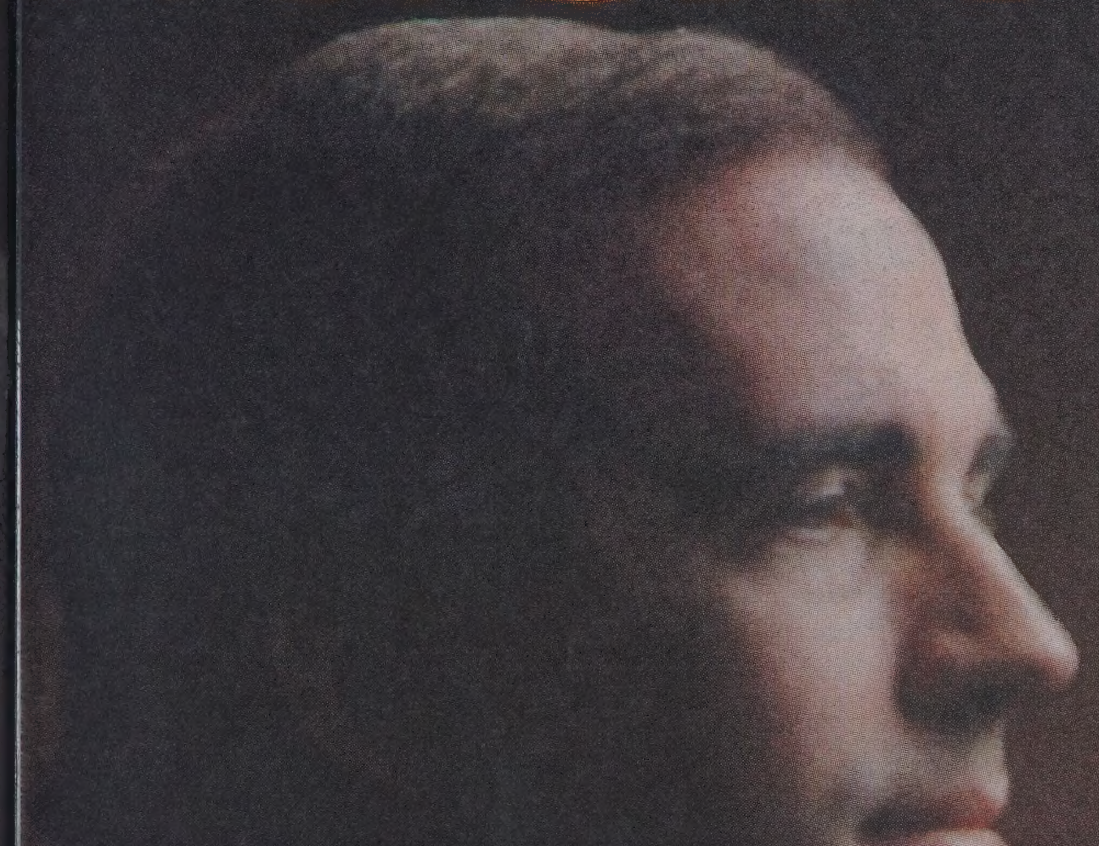

Eric Drexler: "With molecular manufacturing, it will be possible to make machines that are smaller than a bacterium and consume so little power that a billion times the capacity of a modern supercomputer could be put in a desktop box..."

Nanotechnology:

Separating Myth From Reality

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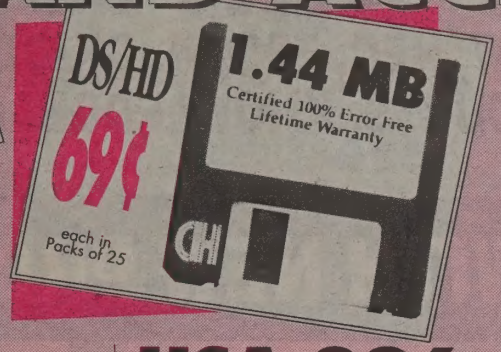

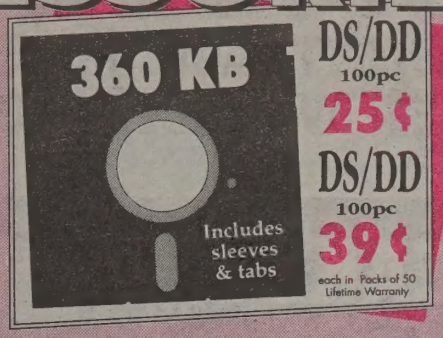

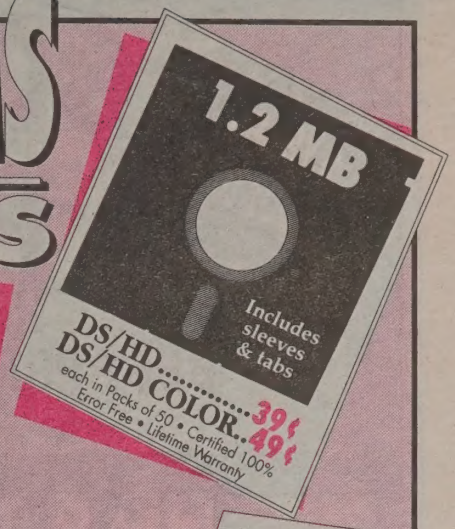

USA 386-33

- Intel Microprocessor
- 64K Cache
- 4 MB Ram
- 120 MB Hard Drive
- 1.2 & 1,44 Floppy Drive
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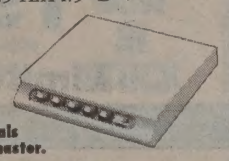

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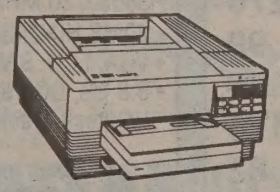

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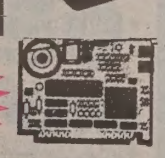

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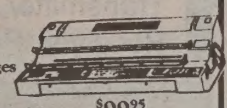

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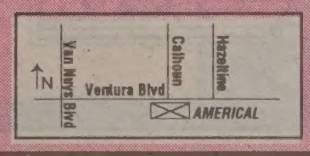

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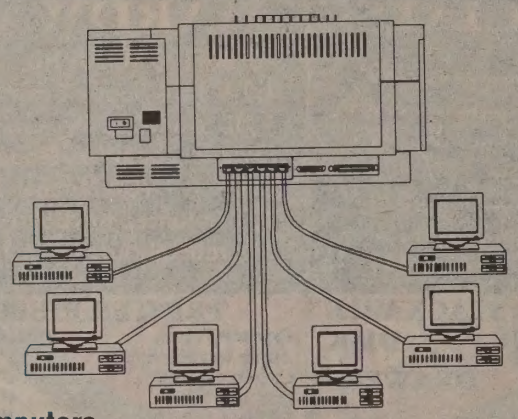

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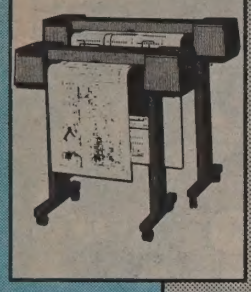

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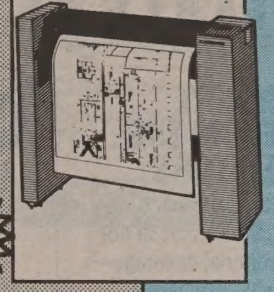

PRINTERS

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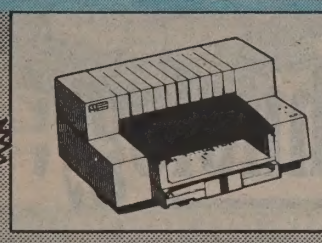

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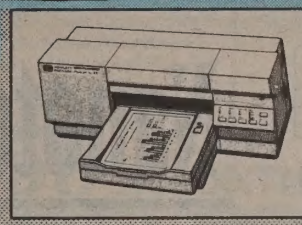

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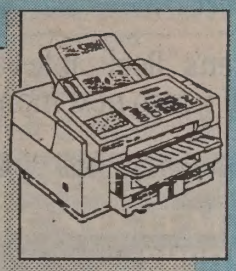

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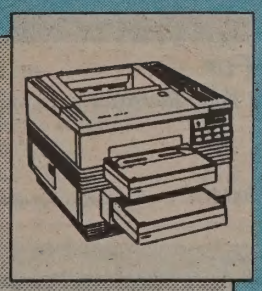

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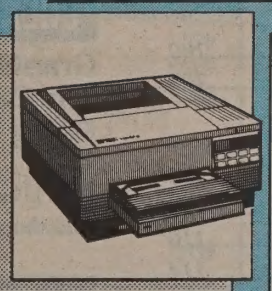

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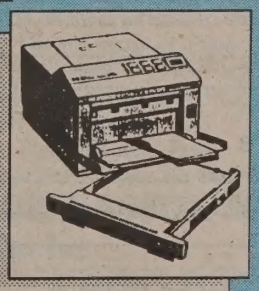

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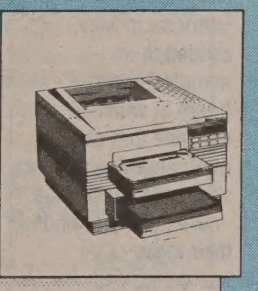

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A NOTE FROM THE EDITORS

Normally when we get futuristic in our editorial coverage—with, say, virtual reality or pen-based computing in years past—we're talking about products that will become reality in the fairly near term. Our cover story this month deals with something that might not attain its fully realized state for decades—nanotechnology, the manipulation of matter at the molecular level. The implications are profound; the potential for world-changing technology and bogus vaporware is vast.

We're pleased to be able to bring you the views of two of the leading thinkers on the subject: Eric Drexler, author of numerous publications on the subject, most recently the forthcoming ***Nanosystems***, and Autodesk co-founder John Walker, who, in our cover story interview in May, alluded to a manufacturing future in which a machine that can make anything will sit on our desktops.

We hope you find their ideas interesting and provocative.

—ME

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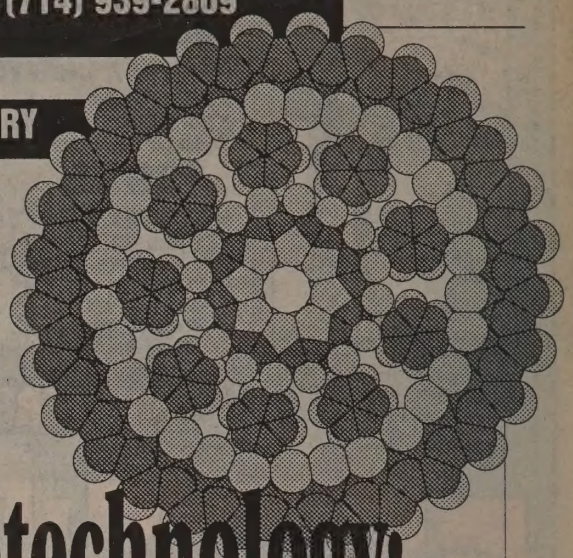

Nanotechnology:

Separating Myth From Reality 66
By Mary Eisenhart
Cover and contents photos: Glenn Matsumura
Nanotechnology pioneer and researcher Eric Drexler discusses the implications of molecular manufacturing for the computer industry and the world at large.

What's Next?
Nanotechnology For Manufacturing 48
By John Walker
Originally given as a presentation at Autodesk, this paper provides an introduction to the subject of molecular manufacturing. It places the field in the overall context of industrial evolution; describes recent progress in physics, chemistry, biology, and engineering; and forecasts CAD's future in the radically different world that results.

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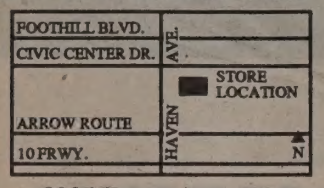

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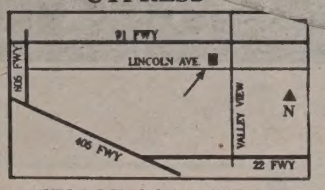

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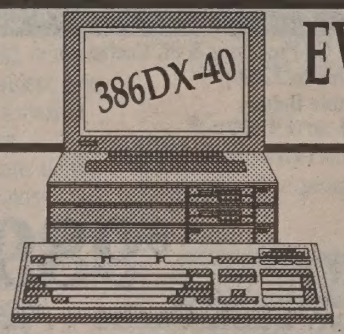

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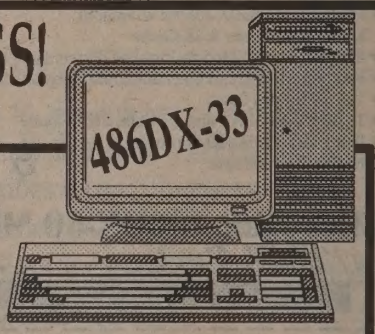

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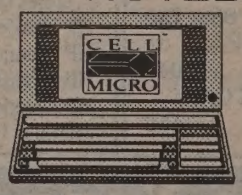

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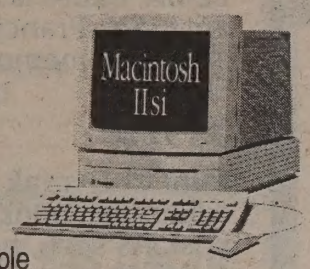

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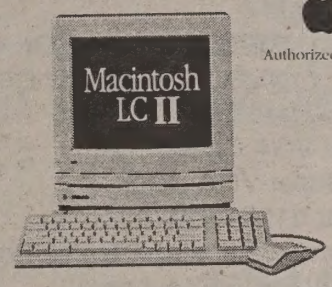

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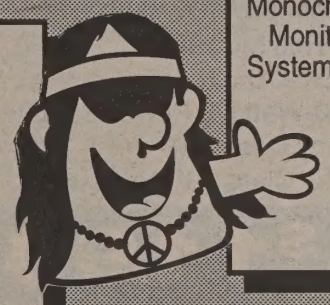

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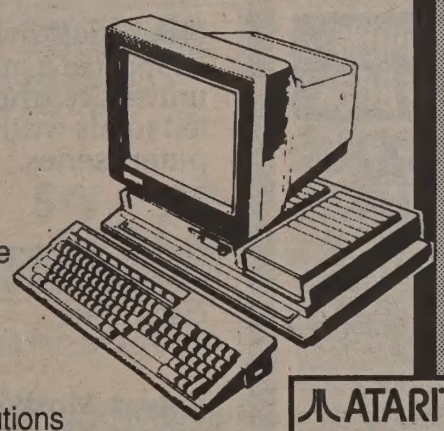

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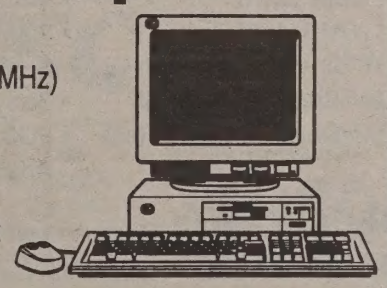

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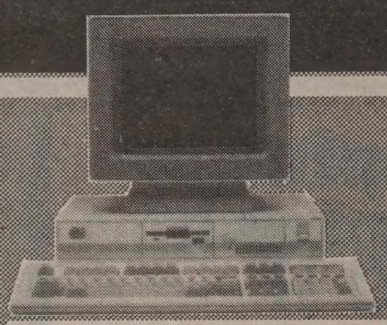

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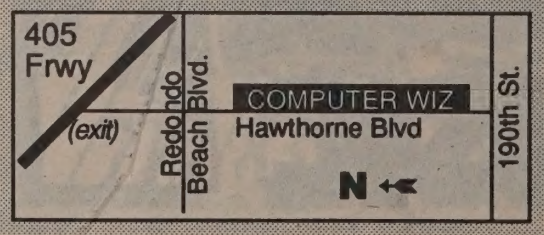

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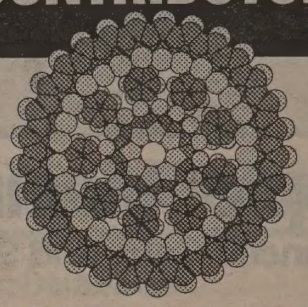

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John Walker is a cofounder of Autodesk and currently works as a programmer in its European Technology Center in Switzerland.

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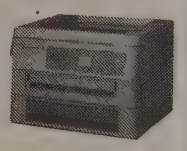

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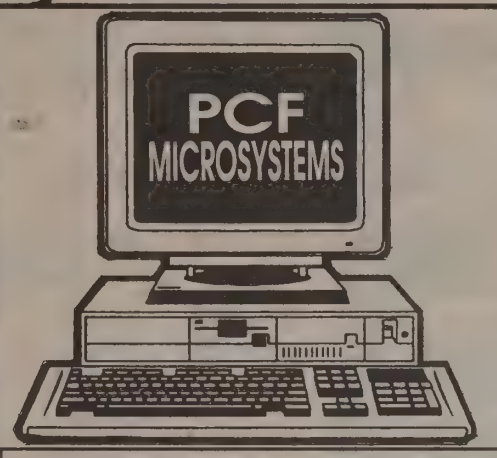

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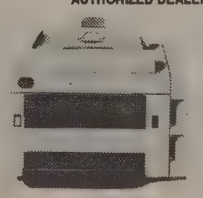

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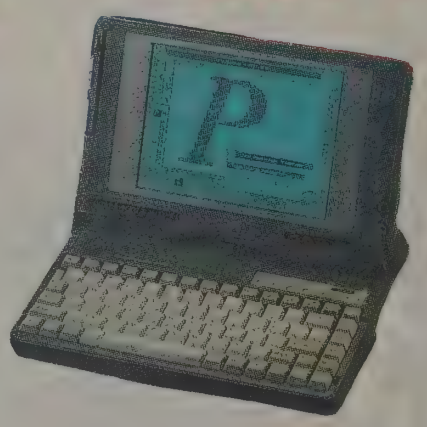

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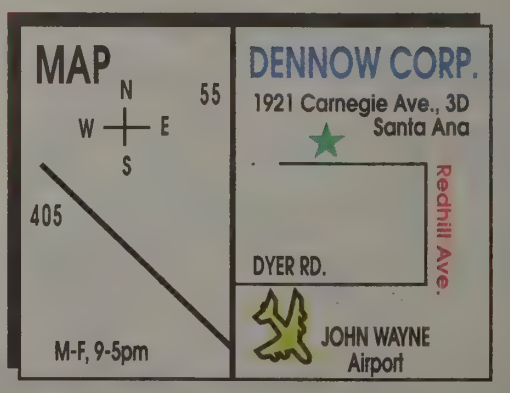

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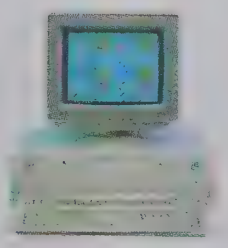

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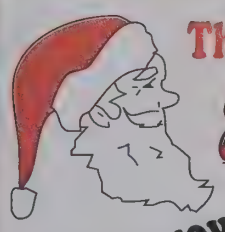

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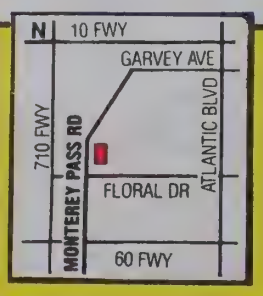

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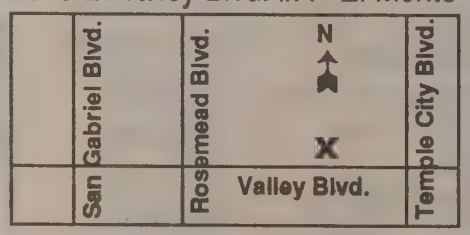

LETTERS

MICROWAVED BRAINS?

I disagree with the implication in your "Working Without A Wire—Outdoors" article (Issue 98N/99S) that microwave communications is a safe medium.

A power level of 65 milliwatts is mentioned as typical for a microwave signal, and is described as being "well under established safety standards."

I am unclear as to what standards are being referred to, as the American National Standards Institute (ANSI) standard is only *one* milliwatt (1,000 microwatts) per square centimeter.

Microwave power levels of 100 milliwatts have been shown under experimental conditions to cause death in laboratory animals after about an hour of exposure, and a wide range of potentially carcinogenic physiological changes have been observed at much lower levels.

Incidentally, cellular telephones operate at frequencies approaching the microwave spectrum, so each time you hold one of those things to your head you are literally microwaving your brains.

John Lankes
San Francisco

We suspect that as wireless technology becomes more widespread, the debate over the medium's safety will make the one over monitor radiation pale by comparison. We also suspect that there will be much research and more argument before there is much in the way of consensus.

—eds.

ANOTHER VIEW OF WORDFINDER PLUS

Matthew Leeds' review of Word Finder Plus by Microlytics (#98) is informative, but I'd like to clarify my experience with it on a couple of points.

I use Word Finder Plus with Word 5.0 and find it very satisfactory. Mr. Leeds stated that "in Word 5 the hot key was not functional." Very strange. I've never had any problem. I utilize the QuicKeys program extensively, and realized that I already had WF's default hot key in use—I changed it after trying various combinations until I found one that did not interfere with any of my other QK functions. Everything I tried did work OK.

In my system I routinely keep twenty Inits active. Mr. Leeds said he had a problem there as well. Probably I'm lucky—all my Inits are compatible with WF Plus.

Yes, Word Finder Plus is active continuously until it's turned off in the control panel. This is one fault that Microlytics should correct, although it does not present a "problem" for me. In SuperPaint I use WF Plus sometimes to check my text for a word that escapes me or to double check the spelling of a word—however, it is only functional in this program as a "reference," not as a "replacement" of words. It also performs well in Panorama and FoxBASE+/Mac, and is excellent with White Knight.

If I had read this review *before* I decided to buy Word Finder Plus, I might not have purchased it, fearing that perhaps it would not function harmoniously with my programs. (Inits not included—any of them can be troublesome periodically.) Though it does lack many words that I'd like to see included, overall my opinion is that WF Plus is a worth-your-money purchase.

Cyrus Gordon
Oakland

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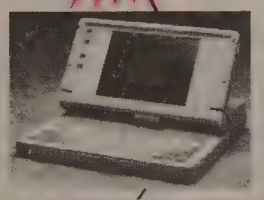

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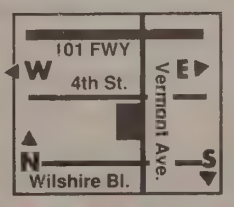

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INDUSTRY INSIGHT

Competition, Silicon Valley Style: Symantec And Borland Trade Charges On Trade Secrets

BY PAUL HOFFMAN

Lawsuits come and go in this industry, and many companies seem to feel that anything is acceptable as long as it is legal.

In a stunning case that shows how far the software industry has stooped, Symantec apparently hired Borland's vice president of programming products, Eugene Wang, and asked him (or at least allowed him) to communicate Borland product plans and proprietary financial data while he was still a Borland employee. Symantec also hired Wang's secretary, Lynn Georganas, who proceeded to take files from Borland after she had left the company.

At press time, Symantec has not denied any of Borland's charges, but has instead accused Borland of improperly bringing the dispute to the public and interfering with Symantec's methods of doing business. Symantec has said that because the dispute will be resolved in court, it is inappropriate to comment on specific charges. Symantec is dealing with the issue as a legal matter, while Borland is dealing with it as a public ethical matter. If found guilty, Wang and Georganas could spend time in jail. Borland has also sued Symantec in a separate civil case.

Job-hopping in high tech industries is common, although top executives do not often go to work for direct competitors of their previous employers without taking a few months or years off. Trade secret laws are usually enforced only in civil proceedings in which the executive's previous company sues the executive's new company to prevent it from using his or her knowledge. Most such cases are settled out of court, due to the difficulty in proving actual exchange of information.

The Borland-Symantec case is quite different. Borland suspected that Wang had taken trade secrets the day he left and searched his MCI Mail account (which was paid for by Borland). MCI Mail keeps copies of your recently-sent letters, and Borland found electronic mail to Gordon Eubanks, president of Symantec, containing trade secrets that were sent while Wang was still at Borland. With this evidence, Borland asked the local police to search Wang's and Eubanks' homes for evidence for a criminal case. According to reports, police found recent confidential salary reports at Wang's house and confidential Borland memos at Eubanks' house. Borland then obtained a standard restraining order against Symantec to return any confidential Borland information and not to destroy any relevant information.

The day after Wang left Borland, Georganas returned to Borland to retrieve what she called personal files. Two days later, after the restraining order had been issued, Georganas asked a personnel officer if she could retrieve more personal messages from her computer. It was arranged that she come in late in the evening to retrieve the additional messages. She copied one or two diskettes more of files onto floppy disks and deleted some files. As she left Borland's offices, Scotts Valley police met Georganas and took the floppies. Borland says that those floppies contain confidential material. Georganas then went to her new office at Symantec and turned over five more floppies to the police, which Borland claims also contain confidential material.

There are, of course, many issues here. From Symantec's view, the main issue is a legal one: did Wang and Georganas break any civil or criminal laws? Given that none of Symantec's press releases deny any of the facts and only chastise Borland for taking the situation public, Symantec tries to shift the blame onto Borland for not keeping the case only in the courts. Borland, on the other hand, by making public statements about what it perceives as the facts in the case, is not content to wait for legal judgments, seeing the issues as those of corporate ethics.

The computer industry has always been interested in the ethics of its major players. For example, when Apple sued Microsoft for the look and feel of Windows, the ethical ramifications were discussed more than the legal ones. The work environment at computer companies is often dissected in the media, particularly with respect to how such companies treat women. How a company conducts itself is significant to many people, and those for whom it is not simply ignore the news.

The market factors that led Symantec to take the steps cannot be ignored. Symantec has a small fraction of the computer languages market, where Borland and Microsoft dominate. Symantec is not known as an innovator in the computer language field, choosing instead to buy technologies. Wang's knowledge of what Borland was going to do in the next six months would be invaluable to Symantec in its positioning of new products. A major ethical issue is whether hiring someone with that kind of knowledge is the proper way to compete in the market.

The legal definition of "trade secrets" is vague and highly subject to the whim of a judge, and the industry has not tried to set down standards for the ethical definition. Regardless, Borland has as much right to go public with its view of the situation as Symantec does in defending itself. Waiting for years for a judgment doesn't serve the industry: it only serves the winning side in the case. If no one is interested in the ethical issues, Borland will look silly for trumpeting them; if the public is interested, Symantec will look sleazy for chastising Borland for "cre-

continued on page 28

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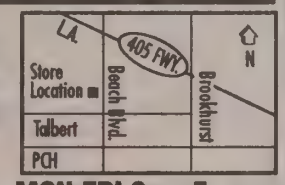

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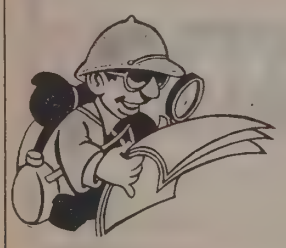

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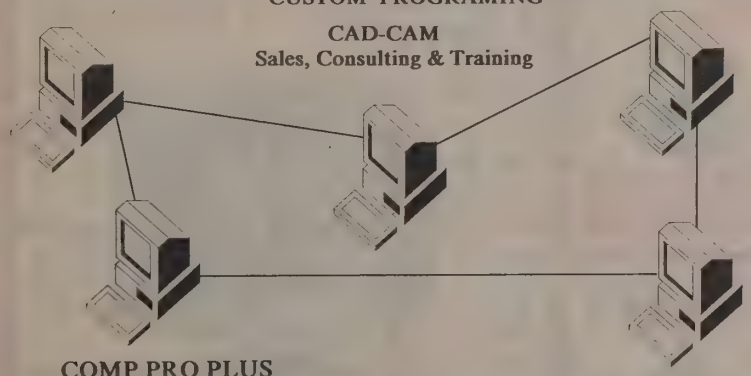

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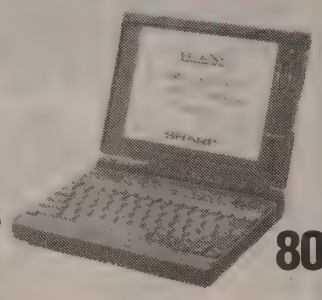

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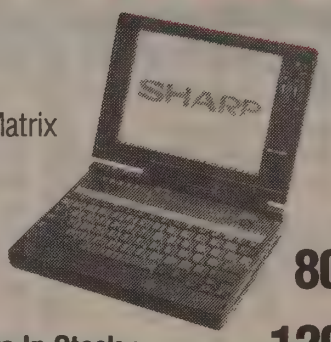

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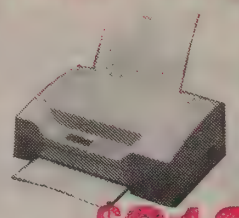

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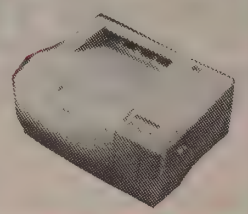

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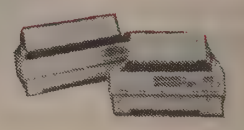

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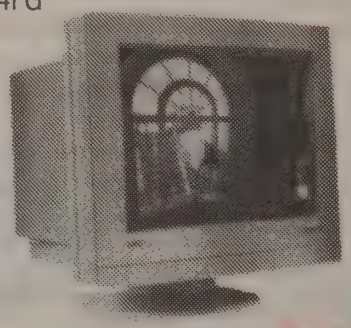

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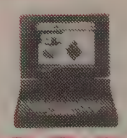

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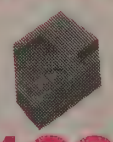

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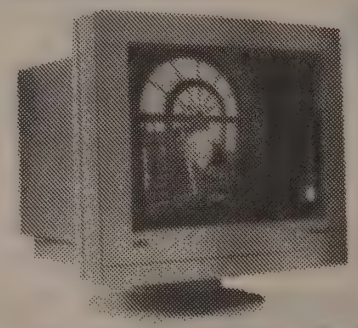

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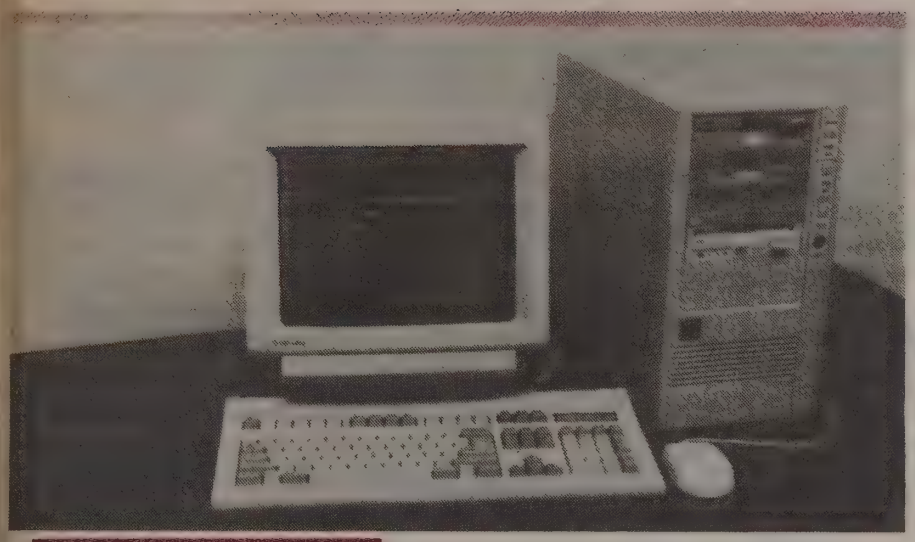

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ating publicity." Either way, the judge in the civil case (and in the criminal case, if one is brought) will decide how much publicity the parties can engage in before the trial.

POWERBOOK 100 PHASEOUT/ RECALL

It is ironic that Apple's first hardware recall comes at the end of the product's life. Apple's new, more powerful PowerBook portables have all but replaced the PowerBook 100, and dealers are offering the small notebook at cutthroat prices, often under $800. Apple was forced to recall 60,000 of the computers, however, to prevent the slight possibility that they might short-circuit and become very hot. Apple said that it only had three reports of the problem, but wanted to assure users that the systems are safe.

Only PowerBook 100s with serial numbers below SQ211 and below SS216 need the free modification. Computers with serial numbers equal to or greater than SQ211 and SS216 were not affected, because Apple changed the design immediately upon hearing of the first instance of the problem. Apple emphasized that only early PowerBook 100s are affected: no other PowerBook models have the problem due to a different system design.

If you have one of the affected PowerBook 100s, call Apple at 1-800-572-1731 to schedule an express pick-up of the computer. Apple will make the simple change to the system and return the unit, also by express delivery. Apple expects the total time users are without their systems to be about three days.

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MICROSOFT'S LOW-COST SOUND SYSTEM

Years ago, Microsoft wanted everyone to buy mice for their PCs. At the time, mice were expensive and very few software titles had mouse capabilities built in. So Microsoft introduced an easy-to-use, low-cost mouse that quickly became the standard other companies had to compete with. Mice are now ubiquitous, and Microsoft Windows assumes that you have a mouse or similar device.

Following the same logic, Microsoft has shaken up the business sound market by introducing a low-cost sound board for Windows that allows you to record and play sounds at a much lower cost than competing systems. While some may accuse Microsoft of trying to elbow out current sound vendors, Microsoft sees this as the only way to assure that a significant percentage of business systems have sound capabilities. Currently fewer than 10% of systems running Windows have sound boards; if this strategy is successful, Microsoft could triple that number within a few years.

The Microsoft Windows Sound System (another Microsoft product with a really catchy title) consists of a sound board, headphones, a microphone, and software. The board has five connectors: speakers and headphones out, audio in, and microphone in. The quality of the sound coming from this $290 board is considered to be as good or better for most applications as what's produced by boards costing $1,000, so no one can accuse Microsoft of scrimping on the parts. It will work in any PC with a 386SX or better CPU.

The area in which the package really shines is the software. Without good software, Microsoft would be in the same position as every other board vendor who has a really hard time answering the question "What can I do with it?" The software, which Microsoft will license to other manufacturers, includes recording software, drivers for OLE so that sounds can be embedded into most recent Windows software, and entry-level voice command software. The Voice Pilot software

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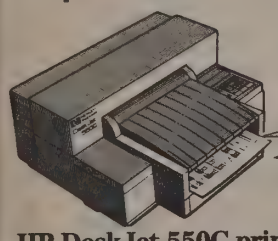

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SCACJET IIP/MAC	$50
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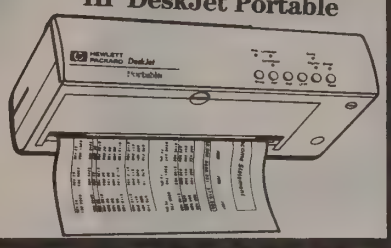
HP DeskJet Portable



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386 SX/25	$850	25Mhz Motherboard, 2 MB RAM, DOS 5.0 5.25", 3.5" FD, 2 Serial, 1 Parallel, 1 Game Prt, MOUSE, 14" SVGA Monitor, 40 HARD DISK.
386 DX/33	$1199	4MB RAM, DOS 5.0 5.25" & 3.5" FD, 120 MG Hard Drive, 2 Serial, 1 Parallel, 1 Game Prt, Mouse, 14" SVGA Monitor.
486 DX/33	$1599	
486 DX/50	CALL	
486 LOCAL BUS33	CALL	

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KX-P2124	$327
KX-P1180I	$158
KX-P1695	$388
KX-P2180	$173
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4MGX9 70 NS	$150

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4MGX8 80NS	$155
PB100,4MG	$195
PB145/170 4MG	$195
PB145/170 6MG	$295

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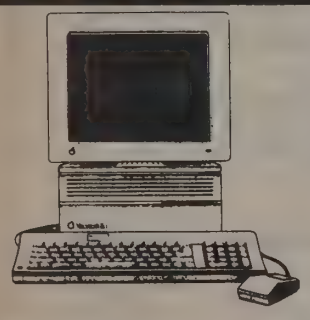
KEYTRONICS	$95
APPLE EXTD	$159

MODEMS

9600 FAX MODEM	$95
2400 INT MODEM	$55
14.4 INTERAL	$295



MAC PB170 4/40	$3,473
MAC PB170 4/80	$3,715
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MAC CLASSIC II 4/40	$976
MAC LC II 4/40	$1,121
MAC LC II 4/80	$1,221
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QUADRA 700 4/80	$3,804
QUADRA 950 8/230	$5,995
MAC IISI 3/40	$1,486

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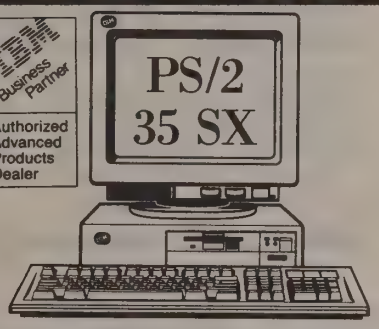

PS/2 MDL 35LS	$1,569
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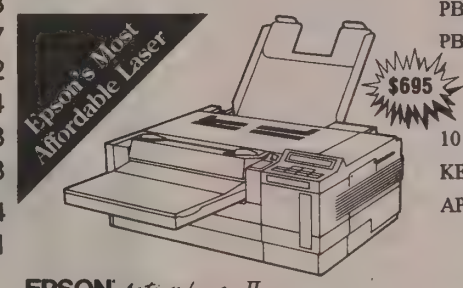

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LQ-1170 PRINTER	$625
LQ-570 PRINTER	$273
AP3250 PRINTER	$200
LX-810 PRINTER,	$174
EPL-8000 LASER	$1,365

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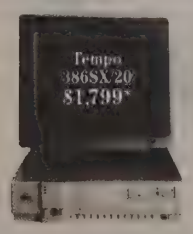

TEMPO C 486/20 4M	$1,205
TEMPO M 486/33,4M	$1,884
CARRIER SL/25, 80	$2,167
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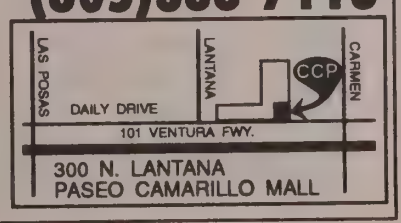

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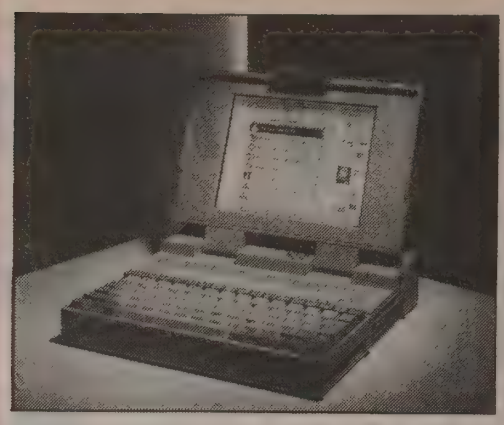

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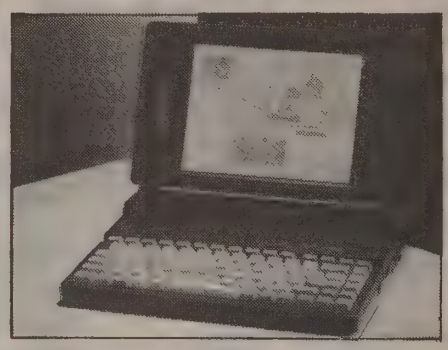
- FREE MS DOS 5.0 & Windows 3.1
- 1.44 MB floppy drive included

	80MB	120MB	200MB
486DX	$2160	$2215	$2395
486SX/25	$1845	$1900	$2080



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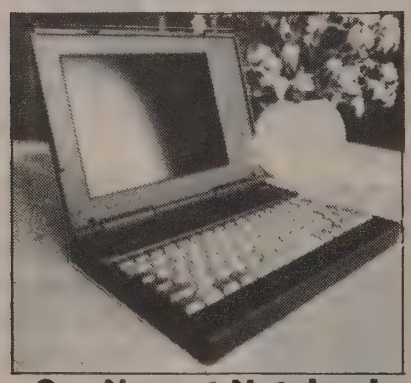
- 1.44MB floppy drive included

	60MB	80MB	120MB
386SL/25MHz	$1495	$1550	$1695
386DXL/33MHz	$1795	$1850	$1990



Our Newest Notebook

CHAPLET 386SL/25 NOTEBOOK

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- CARRYING CASE INCLUDED

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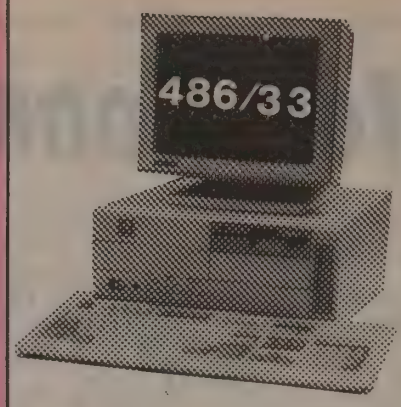

Cyrix 486/33MHz w/Co-Processor

$1395

- 85MB Hard Disk
- 4MB RAM, expandable to 32MB
- 1.2MB & 1.44MB Drives
- Super VGA .28mm dots, 1024x768 resolution
- 16-bit VGA card w/1MB RAM
- 1:1 hard/floppy controller
- I/O: 2 serial/1 parallel/1 game
- 101-key enhanced keyboard
- 1 year parts & labor warranty
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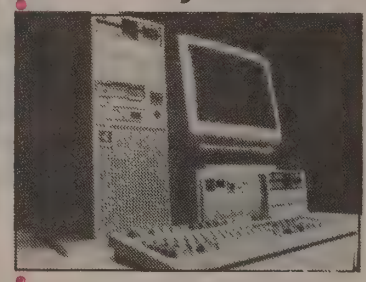
386SX System w/40MB $1050



- Intel 386SX-25MHz CPU
- 40MB IDE Hard Disk
- 1.2MB & 1.44MB Drives
- 1MB RAM, expandable to 8MB
- Super VGA color monitor, .28mm dots, 1024x768 resolution
- Fujitsu 101-key enhanced keyboard
- 16-bit VGA card w/1MB RAM
- 1:1 hard/floppy controller
- I/O: 2 serial/ 1 parallel /1 game
- 1 year parts & labor warranty
- 30-day money-back guarantee

386-33/40MHz System w/120MB $1275/1295

- Intel 386DX-33/40MHz CPU
- 4MB RAM, expandable to 16MB
- 1.2MB & 1.44MB Teac drives
- Super VGA color monitor, .28mm dot, 1024x768 resolution
- 16-bit VGA card w/1MB RAM
- 1:1 hard/floppy controller
- I/O: 2 serial/1 parallel/1 game
- Fujitsu 101-key enhanced keyboard
- 1 year parts & labor warranty
- 30-day money-back guarantee

486-33MHz System w/120MB $1695

- Intel 486DX-33MHz CPU
- 256K high speed Cache memory
- 4MB RAM, expandable to 32MB
- 1.2MB & 1.44MB Teac drives
- Super VGA color monitor, .28mm dot, 1024x768 resolution
- 16-bit VGA card w/1MB RAM
- 1:1 hard/floppy controller
- I/O: 2 serial/1 parallel/1 game
- Fujitsu 101-key enhanced keyboard
- 1 year parts & labor warranty
- 30-day money-back guarantee

486-50MHz System W/120MB $1895

- Intel 486DX-50MHz CPU
- 256K high speed Cache memory
- 4MB RAM, expandable to 32MB
- 1.2MB & 1.44MB Teac drives
- Super VGA color monitor, .28mm dot, 1024x768 resolution
- 16-bit VGA card w/1MB RAM
- 1:1 hard/floppy controller
- I/O: 2 serial/1parallel/1 game
- Fujitsu 101-key enhanced keyboard
- 1 year parts & labor warranty
- 30-day money-back guarantee

MONITORS

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Everview 14" VGA 1024, .39	$239	Sony 1604 17" .25	$1075
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Acer 14" VGA 1024, .28	$299	NEC 4FG	$795
ViewSonic V1 VGA, 640 .39	$239	NEC 5FGX, 17" Multisync	$1595
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ViewSonic 5E, 14" VGA .28	$399	Seiko 1450 non-interlaced	$639
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HP LaserJet IIID	CALL	Epson LQ-2550	$885
Brother HL-10V Laser Printer, 10 PPM		Okidata 320/321	$330/$435
HP III compatible, 1 MB RAM, 35 fonts, PCL-5	$1275	Okidata 390/391	$430/$599
Citizen 200GX	$165	Okidata 393	$950
Citizen GSX-140+	$305	Okidata OL400, 4ppm	$595
Epson LX-810	$175	Panasonic 1180, 192cps	$169
Epson FX-850/FX1050	$329/$429	Panasonic 1124i	$289
		NEW!! Panasonic 2180/2123/2124	CALL

lets you control Windows through voice commands if you are lucky. It is fairly unrefined, and most reviewers have found that the software is quirky at best, certainly not something that you would want to trust your data to.

Other software included with the system converts sounds from other formats (such as from the Macintosh, NeXT, and MIDI files), plays audio CDs, and assigns sounds to system events. The latter may seem trivial, but it has been by far the most used sound tools on the Macintosh.

If this strategy is successful, Microsoft will force its competitors to drop their prices and include software as well. Although this will initially be painful for many companies, Microsoft is betting that the lower price will cause a groundswell of interest in sound for business users. The ideas of using voice annotation and good sound for presentations has been around for a while: Apple introduced them years ago on the Macintosh. Given the total lack of success that Apple had in convincing people to use voice annotations (even in Microsoft's Word program), Microsoft will face an uphill battle to get PC users to use them.

The prospect of voice control is much more exciting, but also more elusive. The amount of processing it takes for a computer to both recognize commands and distinguish them from other similar-sounding commands is huge, much larger than what is available on most PCs that are also running application software. The reliability and sensitivity of the recognition software has to be so good that users will inherently trust it. The first time you say "cut" and the system thinks you said "quit," you will lose faith, particularly if you lose some of your work. Voice Pilot is by no means the best that can be done, but it will be the first exposure that many PC users have to voice recognition. Its unreliability may cause novice users to assume that voice control will never work. ■

Technology News From Japan

(Excerpted from the weekly news digest of Japan Marketing Group, 400 Groveland Ave., Suite 312, Minneapolis, MN 55403, 612/871-7889. JMG covers products and events in the Japanese computer industry.)

•**Ricoh** has developed an electronic still camera capable of recording motion pictures and sounds as well as still images. The company has no immediate plans to market the product, which uses a proprietary chip that combines image compression and memory interface circuits. The camera uses IC cards as a recording medium; a 2Mb card can record 40 still pictures and 400 seconds of sound; an 8Mb version can record TV-quality pictures for five seconds.

•**Autodesk (Japan)** shipped versions of AutoCAD Release 12J for NEC, Seiko-Epson, and IBM PCs on September 25, and plans to ship workstation versions in mid-October. The Sausalito company's Japanese subsidiary, which currently has a 32% share of the PC CAD market in Japan, plans to raise that to 50% within two years.

•With the expiration of its distribution contract with **Canon**, by which Canon had an exclusive license to sell its Mac software in Japan, **Microsoft** has responded to requests from retailers and users unhappy with Canon's limited channels by undertaking direct sales and support of its own software in September. The Macintosh software market is growing rapidly, and Microsoft hopes to triple its Mac software sales in 1993 over the estimated 700-800 million yen in fiscal 1992.

•Suggesting that the US price war in the PC market may be moving overseas, **AST Research** has announced price cuts averaging 14% on its mainstay PC models in the Japanese market, including the DOS/V version of the PC Vision, the English-language Premium Exec, and the Premium SE network servers. Other vendors including **Compaq** and **Dell** are reportedly considering similar moves.

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Socket for 80387 Math Co-Processor
100 Megabyte Hard Drive

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128K Cache

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AST Notebooks!!

All AST Notebooks Include:

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Premium Exec 386SX/25 4Mb Ram 80Mb HardDisk	1699
Premium Exec 386SX/25 4Mb Ram 120Mb HardDisk	1899
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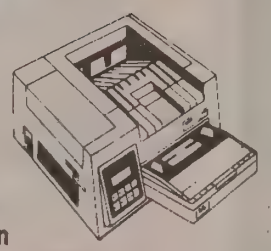

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MicroLine 380 24Pin Narrow	239
MicroLine 590 24Pin Narrow	499
MicroLine 591 24Pin Wide	669
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GSX-230 24-Pin Narrow	299
GSX-240 24-Pin Narrow	399
GSX-145 24-Pin Wide	399
GSX-240/200-GX Color Option	69
GSX-145 Color Option	69
LaserJet Series II	1495
LaserJet Series IIP Plus	799
LaserJet Series IIIP	1050
LaserJet II, III, IIID Toner	89
LaserJet IIP/IIIP Toner	79
DeskJet 500	399
DeskJet 500C	699

MONITORS

CTX 5468 1024x768 .28 14"	299
CTX 5468NI 1024x768 14"	349
Nanao T550i	1350
Nanao T560i	1995
Nanao T660i	2799
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Idek 5217	999
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Inovision - Mag MX 17F	1375
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Sony 1604 1024x768 .25 17"	1099
ViewSonic 5E	450
ViewSonic 6 14" 1024x768 NI	375
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ViewSonic 8 20"	1995

VIDEO CARDS

ATI Ultra + VGA	499
ATI Wonder XL 1MB	219
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Monographics w / LPT Port	29
PVGA	89
Orchid Farenheit 1280 1MB	299
Orchid ProDesigner IIs 1MB	219
Local Bus ET4000	250
Trident (1Mb)	89
Trident 1Mb Hi-Color	150

MODEMS

Best Data 24/96 Fax/Modem Int.	99
Boca 14.4K/96 Fax/Modem Int.	299
Smart One 2400B Int	69
Practical Periferal 14.4 Int.	475
Practical Periferal 14.4 Ext.	500
USR 9600 Fax/Modem	349
USR 14.4K Fax/Modem	399
AST Prem. Exec. Fax/Modem	279

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HP ScanJet IIC (Color)	1450
Microtek MSF600Z (Color)	1350
Microtek MPII (ASF & OCR)	995

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Sony 535E (Ext.)	475
NEC CDR83M (Int.)	520
NEC CDR84M (Int.)	575
Sony CD Caddies	20

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HP III Memory Board 0Mb	49
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Falling Interest Rates, Bush's Economic Plan Spark Rally In Computer Stocks

The one–two punch of dramatically lower interest rates coupled with Bush's economic stimulus plan triggered a rally in computer stocks last month.

Specifically, Treasury bill rates fell to their lowest yields since 1963 and long–term interest rates dropped to six–year lows, while President Bush promised lower taxes.

Computer stocks, as represented by the MicroTimes Stock Index, upticked a hefty114.80 points, or 3.59 percent for the month–long session, before reaching a closing mark of 3313.28. Nationally, the Dow Jones Industrial Average slipped 17.29 points, down .53 percent to close at 3250.32.

In our index, advancing issues outpaced declining issues by over a 2–to–1 ratio.

Turning to computer stocks:

Intel Corp. continued to impress investors last week after the chip maker said it sees 4 to 5 million of its 486 and 386SL computer chips sold in its fourth–quarter – up markedly from the 1 million chips sold a year earlier. Intel also announced plans to pay its first quarterly dividend, a move analysts' said is a reflection of the firm's financial strength. For the month, Intel made a healthy stride forward to gain 12.12 percent, or $7 a share, and was our portfolio's largest dollar gainer. Shares of Intel closed at $64.75.

Symantec was unable to ride the rally in computer stocks last month as that stock plummeted 39.71 percent, or $6.75 a share, to its 52–week low of $10.25. The California software developer forecasted it will post a second–quarter pretax restructuring charge of $1.5 million to $3.5 million in addition to a $2.1 million charge related to two acquisitions. Symantec also said it expects its second–quarter revenue will be "substantially lower" than many analysts expectations. As a result, Symantec was the largest percentage and dollar loser of the lot.

IBM surrendered $5 a share, or 5.73 percent, to close at $82.25. Dean Witter, Morgan Stanley, Merrill Lynch, Alex Brown & Sons, and Cowen all downgraded the stock and cut their earnings estimates for the computer giant. Separately, IBM said it would delay introduction of its low–priced PCs to avoid a similar supply shortage that has plagued COMPAQ. Also, the company shuffled its management structure in Europe to help a reorganization effort in that division.

Fellow computer concern, Digital Equipment, watched its share price climb $3.50 a share, or 9.56 percent, before closing at $40.13. Unlike IBM, however, Digital was the recipient of bullish comments from Smith Barney, which labeled the stock a "speculative buy" at its current stock price.

EXCH	COMPANY	TICKER SYMBOL	CLOSING PRICE 08/28/92	CLOSING PRICE 09/25/92	NET CHANGE IN MONTH	PERCENT CHANGE IN MONTH	P/E RATIO	ANNUAL DIVIDEND RATE	ANNUAL DIVIDEND YIELD	ANNUAL HIGH	ANNUAL LOW
	SOFTWARE										
OTC	Adobe (L)	ADBE	33.00	28.25	–4.75	–14.39	14	0.32	1.13	68.50	28.25
OTC	Aldus	ALDC	12.00	12.75	0.75	6.25	14	0.00	0.00	45.00	11.50
OTC	Autodesk	ACAD	45.50	43.38	–2.13	–4.67	22	0.48	1.11	52.00	23.25
OTC	Borland	BORL	40.25	38.25	–2.00	–4.97	–	0.00	0.00	86.75	35.00
OTC	Informix (s)	IFMX	18.75	20.50	1.75	9.33	19	0.00	0.00	22.00	3.88
OTC	Lotus	LOTS	16.25	19.13	2.88	17.69	13	0.00	0.00	38.75	15.50
OTC	Microsoft	MSFT	74.38	78.75	4.38	5.88	33	0.00	0.00	88.84	57.50
OTC	Novell (s)	NOVL	25.13	28.13	3.00	11.94	19	0.00	0.00	32.50	17.75
OTC	Oracle	ORCL	17.38	19.00	1.63	9.35	39	0.00	0.00	21.13	12.00
OTC	Software Publishing	SPCO	10.00	9.25	–0.75	–7.50	–	0.00	0.00	26.25	7.50
OTC	Symantec (L)	SYMC	17.00	10.25	–6.75	–39.71	11	0.00	0.00	51.00	10.25
	HARDWARE										
OTC	Apple	AAPL	45.00	45.50	0.50	1.11	11	0.48	1.05	70.00	42.75
OTC	AST Research	ASTA	12.25	15.00	2.75	22.45	7	0.00	0.00	32.25	11.25
NYS	Commodore	CBU	7.50	7.25	–0.25	–3.33	9	0.00	0.00	19.25	6.75
NYS	Compaq	CPQ	30.63	33.63	3.00	9.80	41	0.00	0.00	35.75	22.13
NYS	Digital Equipment	DEC	36.63	40.13	3.50	9.56	–	0.00	0.00	65.50	33.25
OTC	Dell (H)	DELL	24.88	28.13	3.25	13.07	15	0.00	0.00	29.13	13.91
NYS	Hewlett–Packard	HWP	55.75	57.75	2.00	3.59	16	0.80	1.39	85.00	44.63
NYS	IBM	IBM	87.25	82.25	–5.00	–5.73	11	4.84	5.88	104.75	81.63
NYS	Silicon Graphics	SGI	21.88	18.50	–3.38	–15.43	–	0.00	0.00	29.75	14.13
OTC	Sun Microsystems	SUNW	26.63	30.75	4.13	15.49	18	0.00	0.00	35.88	20.75
NYS	Xerox	XRX	74.88	78.75	3.88	5.18	19	3.00	3.81	82.25	59.00
NYS	Tandy	TAN	23.88	27.25	3.38	14.14	12	0.60	2.20	31.25	22.25
	CPU'S										
NYS	Advanced Micro Devices	AMD	9.50	11.50	2.00	21.05	4	0.00	0.00	21.50	7.38
OTC	Intel	INTC	57.75	64.75	7.00	12.12	17	0.00	0.00	68.75	38.50
NYS	LSI Logic	LSI	5.38	6.38	1.00	18.60	–	0.00	0.00	9.88	4.88
NYS	Motorola (H)	MOT	85.88	86.00	0.13	0.15	23	0.76	0.88	91.50	54.00
	COMMUNICATIONS										
NYS	AT&T (H)	T	42.25	43.50	1.25	2.96	93	1.32	3.03	45.38	32.88
NYS	BellSouth Corp.	BLS	53.50	52.00	–1.50	–2.80	15	2.76	5.31	55.50	43.38
OTC	MCI (H)	MCIC	32.63	35.00	2.38	7.28	17	0.10	0.29	36.25	25.25
NYS	Northern Telecom (L)	NT	34.25	32.63	–1.63	–4.74	17	0.36	1.10	49.25	32.63
NYS	Pacific Telesis	PAC	43.50	44.00	0.50	1.15	17	2.16	4.91	45.00	36.88

Note: Informix and Novell completed 2–for–1 stock splits.

KEY: NYS = NEW YORK ASE = AMERICAN OTC = OVER THE COUNTER
(H) = NEW HIGH REACHED IN PERIOD (L) = NEW LOW REACHED IN PERIOD

MARKET DIARY:

ADVANCES	22
DECLINES	10
UNCHANGED	0
NEW HIGHS	4
NEW LOWS	3

MOST ACTIVE ISSUES:

LARGEST DOLLAR GAINER	Intel	$ 7.00
LARGEST DOLLAR LOSER	Symantec	$ –6.75
LARGEST PERCENTAGE GAINER	AST Research	22.45 %
LARGEST PERCENTAGE LOSER	Symantec	–39.71 %

	CLOSE 08/28/92	CLOSE 09/25/92	NET CHANGE IN MONTH	PERCENT CHANGE IN MONTH
MICROTIMES STOCK INDEX	3198.48	3313.28	114.80	3.59
DOW JONES INDUSTRIAL AVERAGE	3267.61	3250.32	–17.29	–0.53
STANDARD & POOR'S 500 STOCK INDE	414.84	414.35	–0.49	–0.12
N.Y.S.E. COMPOSITE	228.43	227.73	–0.70	–0.31
NASDAQ COMPOSITE	563.56	577.20	13.64	2.42

CLOSING QUOTES FOR GRAPH:

DATE	MICRO TIMES	DOW JONES
03/13/92	3888.19	3235.91
04/10/92	3566.89	3255.37
05/08/92	3642.36	3369.41
06/05/92	3562.74	3398.69
07/02/92	3182.43	3330.29
07/31/92	3367.19	3393.78
08/28/92	3198.48	3267.61
09/25/92	3313.28	3250.32

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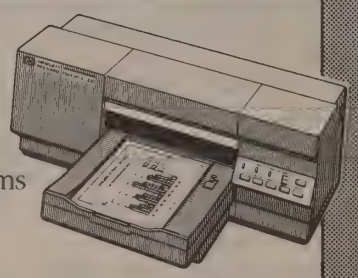

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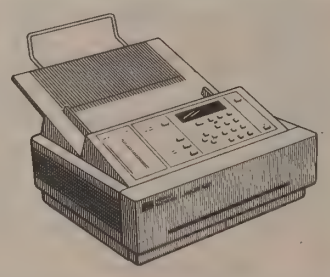

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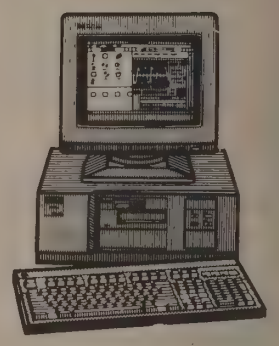

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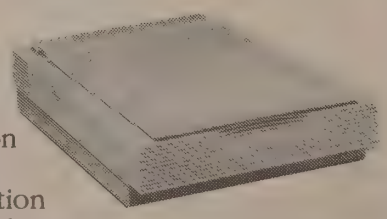

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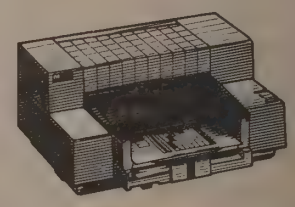

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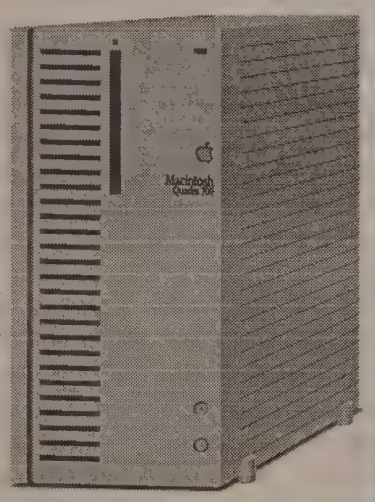

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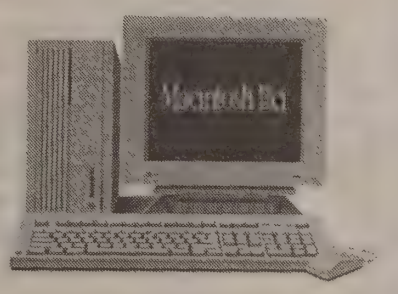

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The New Improved 95LX

Also: Third-Party Support, Wireless Telecommunications, And More

BY MITSU HADEISHI

Since the Hewlett-Packard 95LX was released early last year, demand for this small PC-compatible palmtop has far outstripped HP's original projections. HP itself was not really prepared for this; at first, demand greatly exceeded supply, and though the machine is now readily available in the stores, direct support from HP is still relatively sparse. As a result, support networks have begun to surface among avid 95LX owners in the form of third-party newsletters and accessories.

This 95LX is currently available in two varieties: the original 512K version, which now retails for $599, and the newer 1MB version, currently with a list price of $699. The unit measures 6" x 3.5" x 1", and weighs in at a light 11 ounces. This makes it slightly smaller and somewhat thicker than the Sharp OZ-8000, and about the same overall size as a Psion Series 3.

The screen is capable of displaying sixteen lines by forty columns of text. The operating system is DOS, which means you can run any number of DOS applications directly, and there are now hundreds of DOS applications which have been specially converted to use the 95LX's smaller display. A number of programs are built into ROM, most notably a complete version of Lotus 1-2-3 Release 2.2, and organizer functions such as a calendar, to-do list, memo pad, address book, financial calculator, and a simple communications program.

Open, the unit displays its HP calculator lineage; the keyboard is made up of small, squarish calculator-like keys, spaced quite close together to accommodate a numeric keypad on the right-hand side of the unit. Though this makes quick typing difficult, the excellent tactile feedback of the keys helps. The machine also features a PCMCIA 1.0 card slot, primarily for memory expansion (up to 2MB per card) or ROM application cards, as well as a built-in serial port and infrared port for communicating with another 95LX.

The design of the built-in applications is somewhat less intuitive than the equivalents on many dedicated palmtop organizers; the user interfaces are generally more clunky, and, because the unit is DOS-based, it is not quite as easy to run multiple applications at the same time. For example, you can run any standard DOS application, but before you are allowed to do this, you have to "quit" any of the other applications that happen to be running (and save the data to a simulated disk file). This is somewhat less intuitive than the operation of other, non-DOS organizers (like the Sharp Wizard or the Psion 3), which have special-purpose operating systems designed specifically to support multiple simultaneous applications. The built-in applications, however, are specially designed to coexist with each other and run "at the same time."

Another drawback to the use of DOS as a palmtop operating system is that data is often duplicated when you're editing it. Data which resides on the simulated disk is read into memory as well, meaning you have information on the simulated disk as well as in RAM, effectively halving the total amount of data that can be used in a particular application. This problem can be ameliorated by carefully written applications designed for palmtop use, but the typical DOS application is not usually written to efficiently use a palmtop's limited RAM/disk resource. However, the newer 1MB units help considerably to expand the units' capabilities in this regard.

Where the 95LX really shines is in its extensive computational capabilities. The built-in Lotus 1-2-3 v2.2 is quite full-featured, and has been modified only to make better use of the smaller screen. It includes all the graphing functions, and can even be linked to the financial calculator using the "solver" function of the calculator. To those users already familiar with Lotus 1-2-3, this unit provides ample portable functionality for those people who need to take their spreadsheets with them.

The other built-in functions of the 95LX don't quite measure up to the ease-of-use and elegance of the other popular palmtop organizers, but they are quite adequate from a functional point of view. For example, use of graphics is generally nonexistent; little touches like the World Time feature which, on most other palmtops, is accompanied by an (admittedly spurious) silhouette of the continents of the world, is missing from the 95LX's no-nonsense text-only approach.

In general, this machine is designed for functionality, not for style. However, at present, the 95LX represents an excellent value for the price, and its PC compatibility gives it extra versatility. Due to its DOS compatibility, you can run DOS personal information managers (PIMs) instead of using the built-in programs. Pressure from Apple and other manufacturers who are gearing up to introduce either higher-powered or less expensive units, however, may provide interesting competition during the upcoming year.

THIRD-PARTY 95LX SUPPORT

As I mentioned before, a nascent third-party support industry has sprung up around the 95LX. Here are some of the more noteworthy options currently available:

Personalized Software, Inc. publishes a bimonthly newsletter called the *HP Palmtop Paper*, with a subscription price of $39 a year. It includes tips and tricks, advertisements for third-party accessories, and lists of 95LX-converted DOS software; every subscription includes a disk filled with compression programs, games, utilities, and Lotus 1-2-3 templates and macros.

A company called Palm Tree Products, based in Waltham, MA, distributes a number of useful accessories, including three different models of carrying cases (belt, breast pocket, and wallet-style) and other useful accessories for the HP palmtop.

Globalink, Inc., produces a line of two-way language translator cards, including Spanish/English, French/English, and German/English. These cards retail for $299. The system is capable of translating entire documents, and will give you a "bilingual interlinear file" that allows you to view each sentence

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386SX-25 Mhz Motherboard	179.00	Diamond Stealth Super VGA Card	245.00
Mylex DCE376 EISA SCSI Cache w/512K	725.00	Diamond Speedstar Hi-Color VGA Card	175.00
[illegible]	[illegible]	Tseng Lab Super VGA Card w/1MB RAM	92.00
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3Com 16-bit Ethernet Card	189.00
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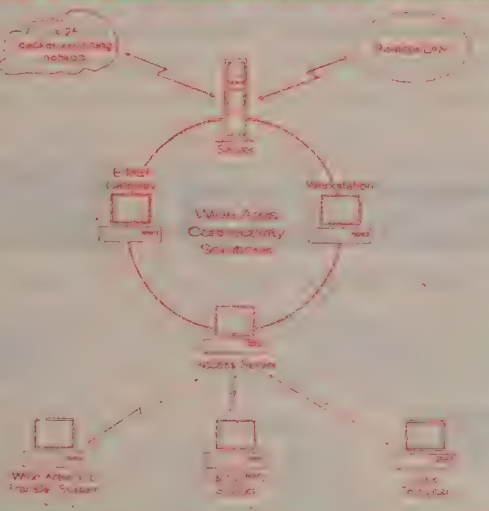

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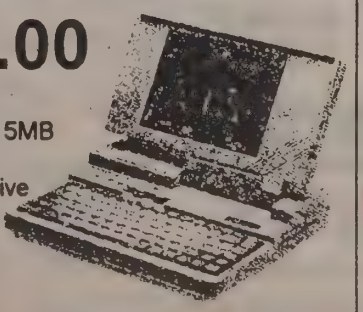

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alternately in each language, giving you the ability to edit the machine-generated translation and "clean it up." Globalink also provides translators with larger vocabularies for use with full-sized PCs.

Soft Warehouse, Inc., based in Honolulu, has produced a 95LX version of its Derive mathematics program. Derive is capable of doing 2-D and 3-D plotting and symbolic mathematics including matrix operations, algebra, and calculus. Derive for the 95LX retails for $289.

Extended Systems produces a nifty device called JetEye for $129. It allows you to print directly to any model of HP LaserJet printer via the infrared port. This eliminates the hassle of having to connect the 95LX to your PC with a serial cable. In addition, the JetEye allows for file transfer to and from your desktop PC.

Motorola's NewsStream mobile "Advanced Information Receiver" will allow your 95LX to receive information such as electronic mail, personal schedules, news, weather, traffic reports, stock market information, airline schedules, and the like. These services are not yet in place; however Motorola intends to market these information receivers for a number of palmtop computers, including the 95LX.

IntelliLink, Inc. has developed a Microsoft Windows application that eases file transfer between the 95LX and your PC. IntelliLink is HP NewWave-aware, and includes connectivity with IBM PROFS, Borland Sidekick 2.0, Microsoft Word for Windows, Microsoft Excel, AmiPro, Lotus 1-2-3, Paradox, dBASE, and other Windows 3.x built-in applications.

PAMCO produces the CD3568 Card Drive which connects to a PC parallel printer port and allows the PC to access HP 95LX PCMCIA 1.0 memory cards as though they were an external disk drive, with a data transfer rate of up to 80kbps. This allows the PC to access information on a memory card faster than is possible using the serial link.

MOBILE COMPUTING

Wouldn't it be convenient to be able to check and even send your electronic mail while you're sitting on the train, or when you're on the road, far from a phone jack? Well, the time might not be too far off.

Right now, you can use a cellular modem to connect to your favorite remote service; however the per-call charge is rather high, and there is no way for the remote machine to notify you when incoming mail has been received. New alternatives to the cellular modem, however, are just now coming to the surface. The Motorola NewsStream™ service, discussed in this and earlier columns, has the advantage of being able to use a very small, lightweight, one-way receiver. You cannot send information via this network, however.

RAM Mobile Data is a wireless data service which provides mobile computer users with two-way data transmission service, using a technique similar to a cellular phone system. However, it is designed specifically as a data packet-switching network, which means it is much better suited for data transmission than using a cellular modem. In particular, in contrast to a cellular phone, there is no significant delay waiting for a connection, and data packets can be very small, costing as little as three cents for a single packet of information.

At present, the cost for transmitting data is approximately 25¢ per 1K of data, with no extra long-distance or connect charges. This is competitive with a cellular modem for small file sizes; a large file, however, can be transferred more cost-effectively using a cellular modem. Currently, RAM Mobile Data is set up to service private companies with vertical-

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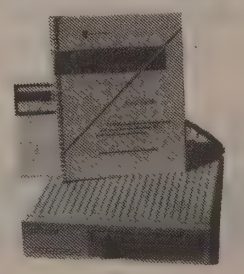

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market applications, but these networks might eventually be used to provide consumer services as well. Recently, RAM Mobile Data announced the addition of TCP/IP networking support, allowing portable computers to use standard TCP/IP-based software such as FTP (a file-transfer protocol) and SMTP (a mail-transfer protocol). RAM Mobile Data is a cooperative business venture between RAM Broadcasting and BellSouth.

Ericsson GE, a division of General Electric, has begun shipments of the Mobidem portable wireless modem for use with the RAM Mobile Data Mobitex networks. The Mobidem is specifically designed for use with palmtop, notebook, and laptop computers, and will allow mobile computer users to travel around town or around the country and stay connected. Approximately the same size and shape as a small cellular phone, the Mobidem connects to your portable PC via any RS-232 compatible serial port, and will constantly scan the Mobidex network for incoming information, even when the PC it is connected to is turned off.

Mobidem modems are currently sold via a remarketing agreement with RAM Mobile Data; however, PC dealer distribution is expected to begin this fall. At present, this technology is still a bit pricey, but the existence of this product suggests that the time may not be too far off when the average consumer can expect to have mobile two-way connectivity within his/her grasp. The current retail price of the Mobidem is $1795.

MORE PCMCIA NEWS

SMART Modular Technologies has created an interesting spin on the PCMCIA memory card market; its SmartRAM memory card combines flash RAM and regular static RAM on one card. If you recall, flash RAM is used in palmtop computers to simulate a hard disk; it keeps its memory even when no power is applied. The drawback of flash RAM is that it requires a high-voltage pulse to rewrite the memory, making it unsuitable for anything but long-term storage. Static RAM, on the other hand, is used for applications that require a lot of writing as well as reading of data; however, it is more expensive and requires a small amount of power to retain its data.

The SmartRAM card combines both technologies into one card: 256K of static RAM and 768K of flash RAM. Programs and infrequently changing information can be stored in the flash RAM, whereas the static RAM can be used for information that requires a lot of writing. This can reduce the total power consumption used by the card. The suggested retail price of this card is $160 for a 1MB card. The SMART company also plans to produce a 2.76MB card and a 20MB card in the near future. ■

Where the 95LX really shines is in its extensive computational capabilities. The built-in Lotus 1-2-3 v2.2 is quite full-featured, and has been modified only to make better use of the smaller screen.

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- LCD VGA Display
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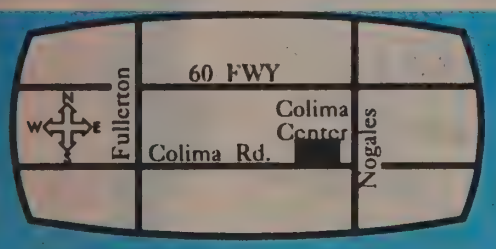

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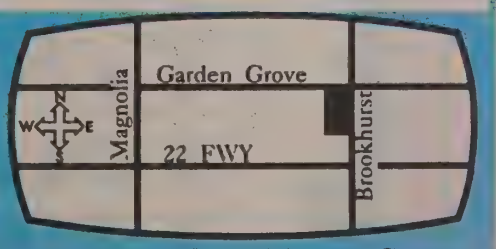

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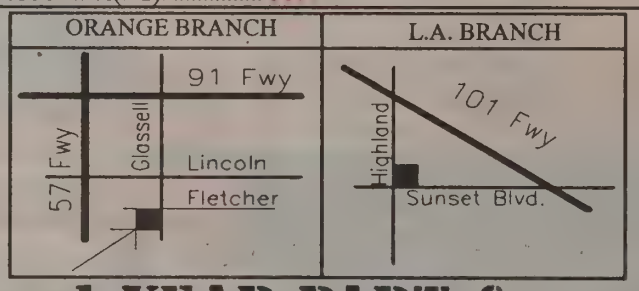

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Working From Home

California Leads The Nation In Recognizing The Benefits Of Telecommuting

BY ROBERT MOSKOWITZ

If you recognize telecommuting as the wave of the future, then you'll be glad to know the US beach most likely to feel its impact first will be California. Already, the surf is a little stronger than usual.

California is well ahead of other states in recognizing the contribution of telecommuting to energy savings, pollution control, industrial competitiveness, and overall quality of life improvement for its citizens. In fact, California planned and implemented a telecommuting pilot project—and even completed it—before most other states were first awakening to the concept. Perhaps most important, California is one of the first states to place laws on its books that support telecommuting among private companies and that extend the scope of telecommuting projects among state, county, and city government agencies.

CALIFORNIA IS HABITUALLY ON THELEADING EDGE OF TRENDS—BOTH MAJOR AND MINOR. AND TELECOMMUTING IS THOUGHT BY MANY TO BE ONE OF THE MOST SIGNIFICANT TRENDS FOR THE TWENTY-FIRST CENTURY.

For example, California has authorized partial funding for three "telecenters" in Ontario, Apple Valley, and Riverside. The telecenters—appropriately equipped public offices and conference rooms that can be booked for use by the day or week—are meant to be used by employees of any qualifying company, much like a telephone booth or a hotel meeting room. Although the charges an individual user pays for time spent working in such a center are presently subsidized by the state, the plan calls for people and their employers ultimately to pay their own way.

In addition to funding telecenters, the state has set up an innovative "space exchange" program in Southern California. This allows participating city, county, and state employees to work some of the time at any available government office, rather than their assigned work location. This allows these employees to cut down on commuting time and distance by finding an alternative work location closer to home.

CALIFORNIA: THE PERFECT PLACE FOR TELECOMMUTING

All this should not be surprising because, thanks to at least three important factors, California is the perfect place in America for telecommuting to catch on. One factor, of course, is that California is habitually on the leading edge of trends—both major and minor. And telecommuting is thought by many to be one of the most significant trends now in sight for the twenty-first century.

A second factor is that telecommuting brings a direct and immediate improvement to the quality of life, something most Californians have long held close to their hearts and minds. Telecommuting not only helps save the environment, it can save a telecommuter's very life by reducing stress, providing more time during the week for family and personal activities, and generally preventing the "death by overwork" syndrome often noticed in Japan and other industrialized countries.

A third factor that makes California a perfect setting for telecommuting is the modern communications technology often involved. According to J. Ron Cross, director of regulatory policy analysis for Northern Telecom, in Nashville, TN, "telecommuting is essentially the art of substituting communications technologies for travel." And where but California are we likely to find so many people at home with so much advanced technology?

TELECOMMUTING PROJECTS

But while talk of the future is mere speculation and conjecture, it's a plain and simple fact that California has already enacted legislation that favors and supports the increased use of telecommuting in California. According to David K. Fleming, director of the state's Telecommuting Project, a recently passed law authorizes (and as a practical matter, encourages) state agencies to use telecommuting as a work option for their employees. He also points to the telecenter funding, the space exchange program, and other planned initiatives on behalf of telecommuting.

Fleming is the mastermind of California's Telecommuting Project, which allows state employees who volunteer for the program to be paid while working from home offices or telecenters. The idea was conceived back in 1983 as a way to help manage and reduce the state government's growing appetite for office space. Legendary telecommuting consultant Jack Nilles was brought in to help plan the pilot program, which was funded in 1987 and completed in December 1990.

According to all accounts, California's pilot telecommuting program yielded extremely successful results. More than two hundred state employees from two dozen state agencies took part, and the report—widely disseminated nationally to those interested in promoting telecommuting—led other states to dispense with pilot programs and go right to implementation. In California, a Telecommuting Unit was created in the Department of General Services to administer telecommuting for other state agencies. There are now well over one

Continued on page 250

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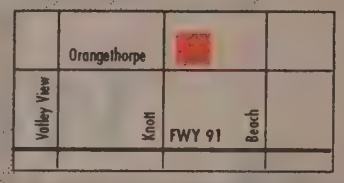

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thousand employees actively telecommuting at least one day a week, and the number continues to grow.

Part of the pressure toward telecommuting in California comes from the need to cut down on the number of commuter trips that employees make every work day. The advantages of telecommuting include improved air quality; better energy conservation; higher employee productivity, morale, and effectiveness and lower health costs and absenteeism.

Telecommuting also tends to improve a manager's or supervisor's skills, simply because he or she can no longer check on the employee just by looking over the cubicle wall. Telecommuting tends to put a greater premium on developing work goals and objectives and using them to help measure the telecommuting employee's results. This helps the manager and the employee do a better job. Smart managers are beginning to apply the same management skills to their non-telecommuting workers to get even greater company wide productivity improvements.

TELECOMMUTING AND TRANSPORTATION

Because telecommuting is seen as part of the effort to reduce the statewide number of "employee commute trips," telecommuting studies and initiatives in California are tied to the state's transportation management program. For example, Caltrans recently contracted with the University of California at Davis to develop as many as twelve "residential-based telecenters" in Orange County, San Diego, and the Sacramento region, and to evaluate their effectiveness in promoting and supporting telecommuting. Responding to transportation management incentives and regulations, Pacific Bell—a private corporation at the forefront of telecommuting experiments and program support—is also part of a consortium developing one or two private telecenters in the Interstate 580/680 corridor in and around San Francisco. (We'll discuss these telecenters in more detail in a forthcoming article.)

The US Congress is presently considering legislation that will follow and expand upon the California lead. For example, House Resolution 5082 would allocate $5 million to develop telecenters in and around Washington, DC. A number of legislators, most notably Senator Al Gore, are promoting the development of a nationwide fiber optic network that would greatly facilitate more and better technologies in support of widespread telecommuting.

Senator Conrad Burns (R-Montana) is working on a telecommuting bill that would seek to provide incentives for more widespread telecommuting and also ease restrictions and smooth out existing legislative and administrative obstacles. In general, these

TELECOMMUTING AND TECHNOLOGY

Technology is an interesting filter through which to examine telecommuting because many people believe that telecommuting and technology are nearly inseparable. Yet the truth is a person needs only a telephone and the skills to use it to get started telecommuting and to be effective. However, there is a clear pattern of telecommuters using more advanced technology to help them stay in close contact with colleagues, managers, clients, and others with whom they must communicate.

Personal computers are particularly common. Some of the first employees to be given a trial in a company's initial telecommuting efforts are frequently people who normally work directly with a computer, such as computer programmers or graphics specialists. In addition, using a computer at home is one of the easiest and most effective ways to telecommute. That's why executives and other white collar employees will often save their computer work for the days they telecommute, and will use their time at the central office for meetings and other relatively low-tech activities. In fact, it's common for fledgling telecommuters to begin using a personal computer specifically to augment their productivity at home or at a nearby telework center. In addition, telecommuters tend to make frequent use of fax machines, modems, and cellular phones.

Because telecommuting is aimed at keeping people in close contact despite the distance between them—or as the slogan puts it: to move the work instead of the worker—today's advanced and super-advanced communications technology offers some very exciting opportunities.

Ironically, Northern Telecom's Ron Cross acknowledges that this nation's massive investment in copper wires, telephone switching centers, and other voice-oriented telecommunications infrastructure once made us the most advanced and productive country on Earth. But now he believes this existing infrastructure is holding us back from installing more modern technologies—including many that are totally proven—that would support telecommuting for millions of workers and make this nation more productive and innovative than ever.

To visualize this, consider how easily people today can converse over any distance, and how common it is to use computer networks or fax to exchange documents in electronic or image form. But if we were free to use currently available technology to build a new public communications infrastructure, we could have faster, more powerful connections that would allow us to include voice, music, and image information along with an ordinary letter or report. Within private networks—such as Northern Telecom's—these modern technologies make it comfortable for telecommuters to dialog across vast distances not only by voice, but by using a variety of information formats.

For example, within some corporate networks, small video cameras mounted on top of the computer monitors allow compressed, almost full-motion pictures to be transmitted between two people talking by telephone. Having a picture of the other person's face, and a view of at least his or her upper-body language greatly enhances the power and immediacy of the information exchange. The camera also allows people to share video images of a product or image.

J. Ron Cross, director of regulatory policy analysis for Northern Telecom, in Nashville, TN, is quick to point out that the Japanese are experimenting with even more advanced technologies. For example, experimenters there are extending virtual reality concepts into business communications, and developing a virtual workspace where two or more people can appear at the same table without leaving their respective offices, and without strapping themselves into gloves and helmets as experimenters now do. With such equipment, a company could assemble teams of workers and have them "meet" as often as necessary regardless of where the individual team members lived or worked. They could even "handle" a product that existed only as a computerized design and a set of manufacturing specifications.

Although at present the visual clarity is unacceptable for commercial applications, within five years the image and sound may be as sharp and three-dimensional as a television picture is today.

— Robert Moskowitz

telecommuting advocates suggest that years ago a highway system helped centrally located states become more productive and economically active in the manufacturing and distribution industries. Today, an "information highway" can provide the same kind of stimulus and basis for less well located states to support throngs of telecommuting workers, and thus to become more productive in a service industry.

Already many large firms have their phones answered in Kansas or another remote location. They could just as easily have their graphics, advertising, market planning and analysis, and other information-intensive activities done by telecommuting workers equipped with advanced technology and supported by tomorrow's "information highway."

TELECOMMUTING TENDS TO IMPOVE A MANAGER'S OR SUPERVISOR'S SKILLS. HE OR SHE CAN NO LONGER CHECK ON THE EMPLOYEE JUST BY LOOKING OVER THE CUBICLE WALL.

But problems and impediments remain, such as the complex and difficult to resolve issues of worker's compensation, and of payroll and unemployment tax. The problem is that telecommuting makes it easy for an employee to work in one state while his or her employer operates in another. Where are various taxes due? How can the parties avoid double taxation? Such questions have no clear answers as yet. Federal and state regulators are looking at possible changes to eliminate these difficulties and make telecommuting a more viable, large-scale option.

BENEFITS

Generally speaking, telecommuting delivers three separate sets of benefits: social benefits, business/management benefits, and employee benefits.

The social benefits include such concerns as better air quality, lower energy usage, reduced commuter traffic, and improved job opportunities for those in remote locations or with mobility restrictions.

The business/management benefits include higher levels of employee effectiveness, productivity, and motivation, as well as reduced overhead expenses and absenteeism. According to Ron Cross, of Northern Telecom, "Any place where telecommuting has been deployed to date, productivity and motivation have been enhanced. One of the real barriers to introduction of it in the corporations has been the concern of managers that 'Gee, I don't really know what Ron is doing at home.' Yet no one has found an area where telecommuting has reduced productivity."

In addition to productivity and motivation improvements, telecommuting gives an organization the ability to recruit employees with relatively scarce talents from a wider pool and a larger geographical area. When a company relocates, key employees need not stay behind. And when a key employee's spouse takes a better job, the change need not disrupt the family's other existing employment and responsibilities.

For the employee, the benefits of telecommuting translate directly and immediately into more discretionary time, more time with the family, less stress, and general health improvements. Commuting costs are much lower, and telecommuters tend to feel more in control of life than employees who travel to the same (distant) office five days a week.

REORGANIZING YOUR WORK

However, telecommuting experiments, pilot programs, and full-scale programs have shown that an employer cannot just kick an employee out the door and expect him or her to become a successful telecommuter. Managers must analyze each job considered for telecommuting to see which of its tasks absolutely must be done at the central office and which ones can be done from a distance. Sometimes, the employee and supervisor must brainstorm to find another way to do the job or segment the responsibilities so the employee can work productively at home or at a telecenter one or more days a week. Examples of successful adaptations to the demands of telecommuting abound.

Even prior to telecommuting, one California Public Utilities Commission manager/supervisor had difficulties with specialists who would go on vacation and temporarily leave the office with no expert in a particular area. When telecommuting was proposed, everyone feared it might aggravate this problem. However, the PUC decided to handle the conversion to telecommuting by having specialists in the main office rotate to cover for those who were working at home. After a while this approach helped the entire staff become cross-trained in each other's specialties, making coverage during vacations much less of a problem.

In many offices, employees restructure their activities to accommodate telecommuting. For example, instead of using a few paper-based files every day, people save up work with paper files and do it during the days they are in the central office. Managers, too, can adapt. Those who like to "call a quick meeting" can learn to put distant telecommuters on a speaker-phone or a conference call with those who are in the office.

Although it's difficult to establish and maintain a good working relationship by telephone and fax, experience shows that once a telecommuter meets someone in person and gets to know them, they can accomplish much of their work without frequent face-to-face contact.

THIS IS JUST THE BEGINNING

Obviously, telecommuting is still in its early stages. But industry is beginning to understand it, and under pressure from federal and state clean air legislation as well as from economic forces, more and more companies are seriously looking at the telecommuting option.

Although telecommuting will never be right for every employee, it will certainly become more widespread. Many proponents feel that once California industry learns how to initiate and support telecommuting successfully, companies in other states will be likely to follow our lead. ■

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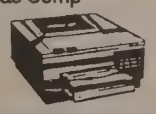

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What's Next?

NANOTECHNOLOGY For Manufacturing

(Originally given as a talk at Autodesk, this paper is widely regarded as an excellent introduction to the subject of nanotechnology, and we're pleased to be able to bring it to you here. By permission of the author, this article may be freely reproduced.—eds.)

BY JOHN WALKER

These are indeed extraordinary times we're living through. Few people are lucky enough to live at a time when their chosen field of interest becomes the center of a technological revolution that changes the face of the world. We've all shared that good fortune; the success of Autodesk in so short a time is evidence of how rapidly and how completely the evolution of computers has changed the way design and engineering are done and has reshaped the very terrain on which businesses compete.

Yet all of these remarkable events were predictable, at least in general outline, more than twenty-five years ago. I remember, like yesterday, the afternoon in the spring of 1968 when, after I first learned about the technologies used in the crude integrated circuits of the time, it hit me. There was no fundamental physical reason you couldn't put a whole computer on a single chip. It was just a matter of engineering, money, and time.

Now I certainly didn't know when it would happen, and I doubt anybody anticipated price and performance reaching their current levels, but the direction and the goal was clear. It made engineering and economic sense, there was no reason it wouldn't work, and each intermediate step along the way would clearly pay for itself in commercially successful products. That pretty much made it inevitable.

This is the kind of reasoning I'm going to be using in this presentation—projecting readily predictable trends forward and asking the question "How far can we go, and what happens when we get there?" Some of the conclusions that seem almost inevitable have profound consequences that are not just interesting, but important for companies like Autodesk who wish to grow and prosper in the coming years.

WHAT'S BEEN HAPPENING

Let's start by looking at the key trend that's driven the entire silicon revolution. It's really very simple: making things smaller, or in engineer-speak, device scaling. In the early days of transistors, it was observed that when you made a device smaller, you got the best of everything. It ran faster, it used less power and ran cooler, and since you could pack a lot more of them on a single wafer and the cost of processing a wafer was the same regardless of what was on it, the price per device went down.

After the first primitive integrated circuits were made in the late 1950s, the incentive to miniaturize became even more compelling. By reducing the size of devices further, more complex circuitry could be packed onto each chip. And remember, all chips cost roughly the same to make, regardless of what they do or how complicated they are.

Integrated circuits started out as devices with just two transistors on a die, and progressed to building blocks for larger systems. Finally, in the mid-1970s, practical microprocessors—entire computers on a single chip—appeared. These initial devices were crude, which led many observers to dismiss them as toys. Indeed, none of the major computer manufacturers of the time played a significant role in the development of what is now the universal way of making computers.

It was the chip makers who pioneered microprocessors and developed them to their current state. Why? Because they were familiar with the inexorable consequences of device scaling, and they knew how far, in time, it would carry the microprocessor. How far have we come? I have a little program, called the Autodesk Benchmark, that I run on various computers to get a feel for how fast they'll run engineering software like AutoCAD. Here's an anthology of results, spanning the history of Autodesk, from 1982 through the present.

In 1982, personal computers were becoming seen as useful tools for serious work, but they were still very, very slow for computationally intensive tasks. A typical low cost PC such as a Commodore took close to an hour to run the program. (Putting this in perspective, to do the same job by hand with a pocket calculator would probably take a whole day.)

More expensive and powerful PCs emerged and slowly reduced this time, making more and more complicated tasks practical. Then, in 1984, the 80286 appeared. The impact of this machine on Autodesk can't be underestimated. Calculations that took half an hour on the PCs that existed when we started the company could be done in a minute on the PC/AT. It's no coincidence that Autodesk's sales took off through the roof right about that time.

But it didn't stop there. Three years later, workstations and PCs based on the next generation of chips had cut this time by another factor of ten—from a minute to about five seconds. And now the newest, shiniest crop of machines just arriving have handed us another factor of twenty—down to less than a third of a second. In eight years, we've seen a task that originally took an hour reduced, by the simple consequences of device scaling—making things smaller—to less than a third of a second.

This kind of technological progress is hard to comprehend, even if you've lived through it. If automotive technology had advanced an equivalent degree, your car that went 55 mph in 1982 would today go 615,000 miles an hour, with the same gas mileage and price. You could drive to the Moon in around twenty-five minutes, if you beat the rush hour and had a good radar detector.

So the inevitable question is: Just how long can this go on? There are reasons to believe the end of progress in electronics through pure application of device scaling may be within sight, although not imminent. When the limits of device scaling are encountered, the linear extrapolation that has driven our industry since the 1950s will come to an end and we'll enter another era. Before getting into that, I'd like to talk about some different perspectives on the kind of exponential growth we've been seeing.

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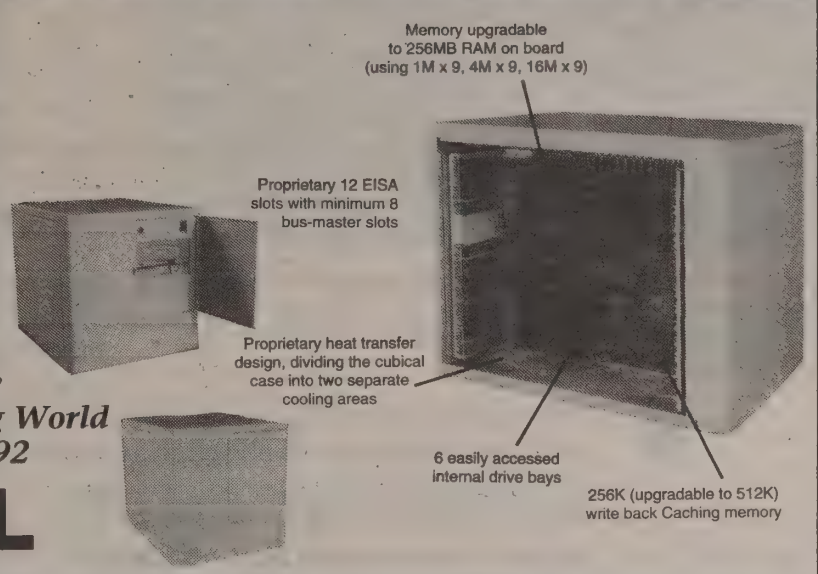
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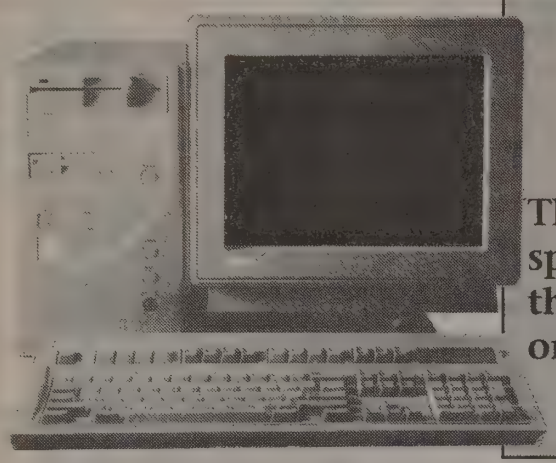

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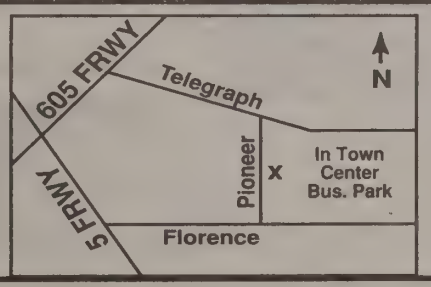

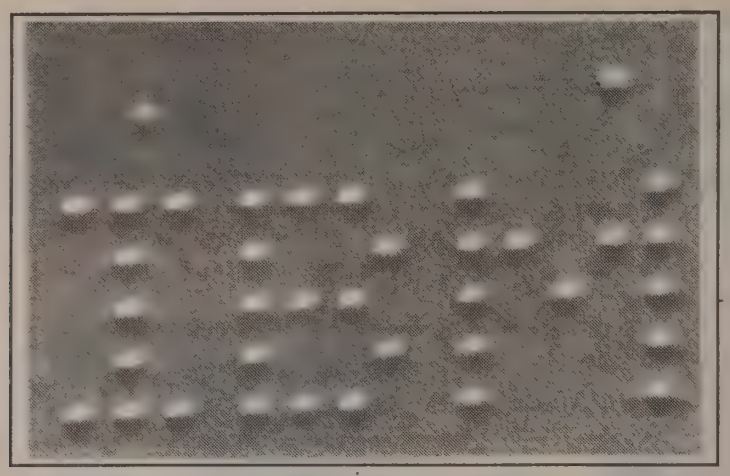

"You can not only put atoms right where the chemist wants them, you can put them right where the marketing department says to, as well"
(photo courtesy of IBM Reaserch Division, from Unboundary the Future)

The first is what I call the "Oh Wow" view of things. You look at the climbing exponential curve and draw the obvious conclusion—it's going to go on climbing to the sky forever.

Now I don't mean to disparage this view; most people err on the side of conservatism—they don't realize just how far a trend can go once it's set into motion. But nothing grows forever. In evaluating any growth trend, whether CPU performance at constant price, world population, or Marin County real estate prices, you have to ask, "What are the fundamental limits to this growth?"

This kind of analysis leads to a different perspective I refer to as the "Oh Well" view. Rather than continued exponential growth, the trend continues until it begins to encounter limits that constrain it, then it flattens out after achieving maturity.

This view is very popular among mainstream business analysts since, especially if you cook up some suitably bogus constraints, you can always justify cutting research and development, reject innovative market expansion and distribution ideas, and relegate the business to a mindless caretaker status once it has reached "maturity." For example, once you've sold a video tape recorder to every TV station, how many more could you possibly sell?

Again, we're not seeing the whole picture. Taking a still longer view gives us what I call the "Oh Shit" perspective: after the limit comes the plunge.

Nothing in this world is static and nothing, regardless of maturity, lives forever. When a technology, or market, or species ceases to grow and develop, it's the strongest possible indication that it's become a dead end—its hand is played out—that decline and replacement are only a matter of time. To understand why, we have to take an even longer perspective.

For this is what's really happening. Progress is made in a series of waves. Each starts with a giddy period of exponential growth. That's when it's fun, when everybody's jumping in, working twenty-four hours a day, losing money hand over fist, and having a wonderful time.

As the curve really begins to soar, it starts having an impact on the established, mature technologies that went before. This is a general-purpose graph [*a curve rises, plateaus, and plunges after being overtaken by another rising curve, which plateaus, and...*]; it's my worldview on a single slide. You can read it as a picture of transistors replacing vacuum tubes and then being supplanted by integrated circuits, or of mainframes, minicomputers, and personal computers, of turnkey mainframe CAD companies, workstation-based CAD, and mass-market desktop CAD software, or for that matter, of species diversification and extinction in an ecosystem. It doesn't matter. It's all evolution in action.

TECHNOLOGICAL TRANSITIONS

I call the points where a rapidly developing technology takes off and

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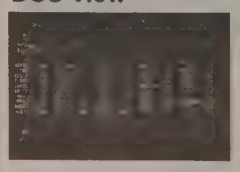
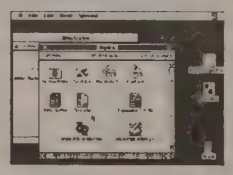
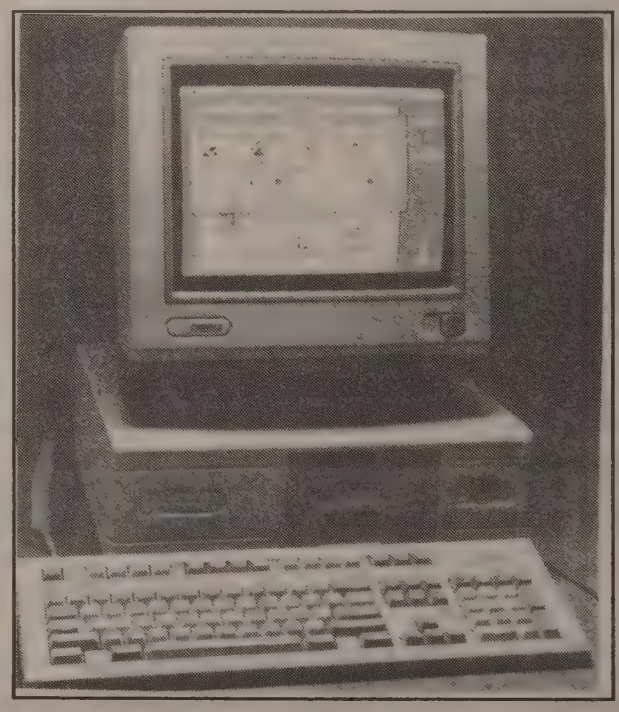


Macintosh View





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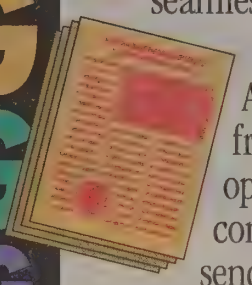

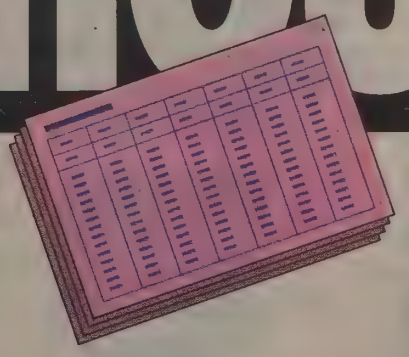

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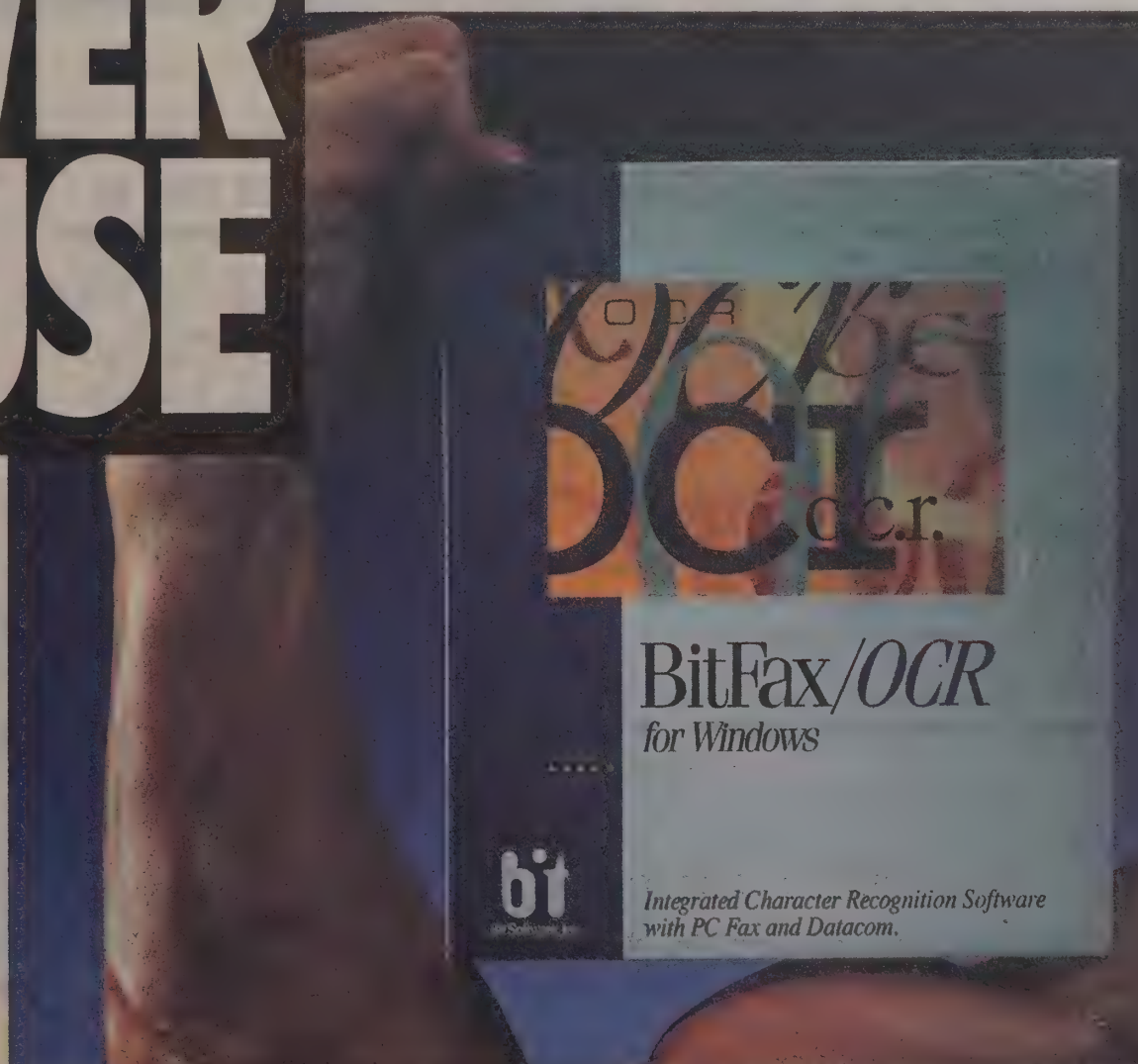

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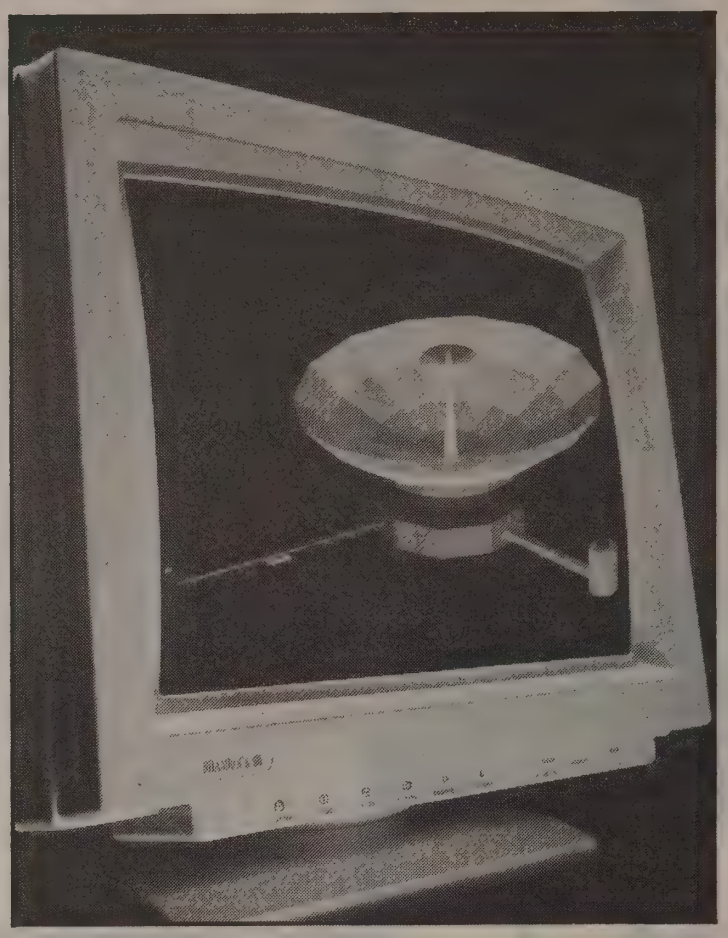

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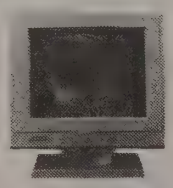

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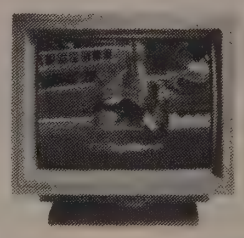

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starts to displace its predecessor "technological transitions." These are perilous times, but they are the times when great industries are founded. Rarely do leaders of the last technology play a significant role in the next; they've usually become encumbered with a bureaucratic superstructure focused on managing a mature market but incapable of acting on the small scale with the rapid pace that's needed to develop its successor—the new market that's inexorably displacing them. Having grown out of their period of rapid growth, they've forgotten it's possible. They value caution over the very assumption of risk that built their industries in the first place, and through caution, they place at risk everything they have.

There was no fundamental physical reason you couldn't put a whole computer on a single chip.

Technological transitions are great times to make gobs and gobs of money. Autodesk got on board a relatively minor technological transition in 1982—the second subwave of personal computers, which was a ripple of the microprocessor surge, itself part of the semiconductor tide, contained within the automation industrial revolution. Even so, we managed to turn a hundred thousand dollars into more than a billion in less than eight years. Just imagine what you could do with a real industrial revolution.

FIVE INDUSTRIAL REVOLUTIONS

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All of this was based on natural materials, picked up from the Earth or taken from plants and animals. Then, about 5600 years ago, on a sunny Thursday morning, somebody figured out how to extract copper from yucky-looking rocks. Now people had access to new materials—technology was no longer limited by what was lying around; it could make new substances and build with them. This led to bronze, iron, alloys, alchemy, chemistry, and steel. This was a material revolution; enabling new technologies by creating substances not found in nature.

All of industry until the eighteenth century was powered by the energy of human or animal muscles, or natural energy sources like falling water and the wind. This limited both the scope and scale of what could be done. The advent of practical steam power swept away these limitations, spawning trains, steamboats, satanic mills, and capitalism. This was an energy revolution.

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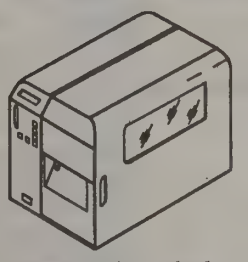

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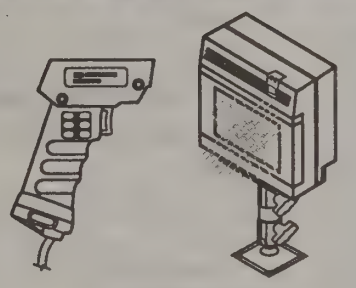

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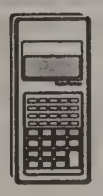

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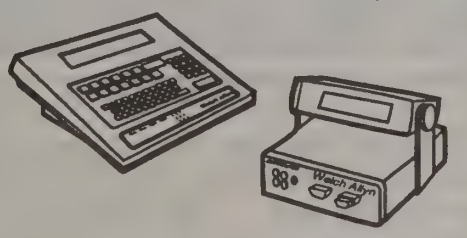

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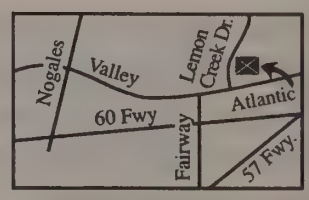

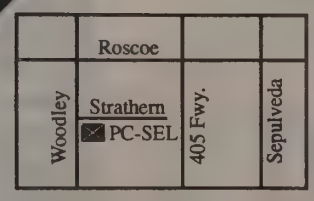

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mately led to an entire industrial system focused around mass production of largely identical objects. This is harder to date. I use 1908, the date of the first automobile assembly line, as the milestone of mass production. Mass production was essentially an information revolution: it embodied a uniform set of specifications in huge numbers of objects, thereby reducing their cost so many more people could afford them than ever before.

I consider automation to be the most recent industrial revolution. Until the advent of mechanical, electrical, and electronic computers in the twentieth century, any computation or information processing required the attention of a human being and necessarily proceeded at the pace a human could work. The computer revolution, which I date here from Eniac in 1946, has been an information revolution that has transformed not only the mechanics of industry, how we make things, but also the structure of our organizations and societies. Ironically, mass production, an essential precursor of automation, is becoming less important as the introduction of intelligence throughout the manufacturing process allows more flexible forms of production.

Before I get into the details of what's about to happen, I want to make sure we understand the territory. We're about to discuss things that range in size by a factor of a billion to one, so it's useful to go over the distance scale so we don't confuse millions and billions the way the politicians do.

Let's start with the measure of all things, a human being. Humans are on the order of meters in size, actually closer to two meters, but we can ignore ones and twos when talking about factors of one thousand, as we're about to do.

Most of the history of technology has been built to this scale, and tended to look something like this [*slide of old-fashioned printing press*]. If an object has to be assembled by people, and in many cases powered by people and operated by people, it doesn't make any sense to make it smaller than people can reasonably use, notwithstanding the design of modern car stereos.

The size of mechanical parts is governed by the materials that compose them and the scale of the machines used to fabricate them. Both imposed severe limitations on miniaturization throughout most of history, limitations that were surmounted only with great difficulty and expense when absolutely necessary, as in the design of watches.

Wherever technology leads us, effective design at this scale will remain important as long as humans use the products. This is the domain of user interface and ergonomics.

If we shrink down by a factor of a thousand, we arrive at the millimeter scale, where an ant is pretty big stuff. This is about the limit of what the human eye can effectively see unaided, or the human body can manipulate without mechanical assistance, so it's a convenient milestone on the road to Lilliput.

Here's an example of millimeter-scale technology. This, for those of you too young to remember or old enough to have had enough bad experiences and deliberately forgotten, is a vacuum tube. If you examine this device closely, you'll see that its fundamental geometry.— the spacing of its grid wires, the distance from the cathode to the plate,—are all on the order of millimeters. With the development of electronics, device scaling immediately became important: the smaller you made a tube, the faster it ran and the less power it used. Unfortunately, the fact that tubes had to be assembled from separate metal parts limited how much you could shrink them.

This particular tube is a 6SN7. That's the type used in the flip-flop circuit of the Eniac, the world's first electronic digital computer of 1946. Each tube, along with a handful of other parts, stored one bit of computer memory: RAM. The Eniac contained eighteen thousand tubes like this, occupied 3000 cubic feet of space, and required 140 kilowatts of electricity. It had about the computing power of a pocket calculator. It was a miracle of millimeter technology. Tubes like this aren't even made in the United States any more; this one came from the Soviet Union and cost $13. Interestingly, that's almost exactly the current price of an 80-nanosecond 1-megabit dynamic RAM, with a million times the storage capacity and 125 times the speed.

Which brings us to the next factor of one thousand in size, to the micrometer range that's the heart of microchip technology. All of these RAMs and ROMs and microprocessors have feature sizes on the order of micrometers. The entire march of processor technology I showed in the timing slide is essentially the story of learning to shrink our circuits from the order of tens of micrometers to single micrometers, and the frontier of electronics in the next several years will be shrinking further, down to fractions of a micrometer. And then what? Well, that's a very interesting question.

Here's a piece of silicon that's been machined into slabs a third of a micrometer wide. This is about the best we can do right now with conventional processing technology, and to give an indication of just how tiny that is, each of those slabs is smaller than the wavelength of deep violet light. Needless to say, this image is from an electron microscope, not an optical one.

All the way down to micrometers, we've been able to design circuits essentially the way we did in the days of vacuum tubes. Yes, the devices and fabrication technologies changed, but the rules of the game like Ohm's law remained the same.

Somewhere between half a micrometer and a tenth of a micrometer, these comfortable assumptions begin to break down. The weird world of quantum mechanics, where the wave nature of the electron becomes apparent, begins to become manifest at this scale and straightforward shrinking doesn't seem likely to work. This suggests we're already uncomfortably near the top of the curve for conventional electronics.

But how far are we from the theoretical limit? Just about another factor of a thousand, it turns out. If we shrink from a micrometer to a thousandth of that, a nanometer, we've reached the scale where atoms become tangible objects. A 1-nanometer cube of diamond has 176 atoms in it.

Designing at this scale is working in a world where physics, chemistry, electrical engineering, and mechanical engineering become unified into an integrated field. This field will be called molecular engineering, and I believe it will be at the heart of the next two industrial revolutions.

PLENTY OF ROOM

Over thirty years ago Richard Feynman pointed out that physicists knew no limits to prevent us from doing engineering at the level of atoms. His words are as true today as the day he spoke them.

Until recently, though, while the lack of physical limits was accepted as commonplace, molecular engineering was thought of as impractical, unnecessary, or requiring breakthroughs in knowledge and technique that placed it somewhere in the distant future. Many visionaries intimately familiar with the development of silicon technology still forecast it would take between twenty and fifty years before molecular engineering became a reality. This is well beyond the planning horizon of most companies.

But recently, everything has begun to change.

WRITING WITH ATOMS

In 1981, Gerd Binnig and Heinrich Rohrer of the IBM Zurich Research Laboratory invented the scanning tunneling microscope. This device, easily one of the most elegant and unanticipated inventions of the century, allowed imaging of individual atoms, and won Binnig and Rohrer the Nobel Prize in Physics for 1986. In 1985, Binnig and Christoph Gerber of IBM Zurich, along with Calvin Quate of Stanford, invented the atomic force microscope. This allowed imaging non-

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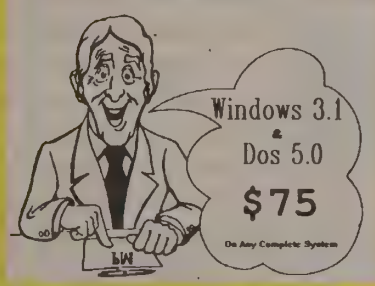

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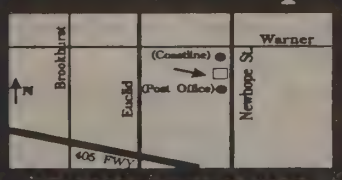

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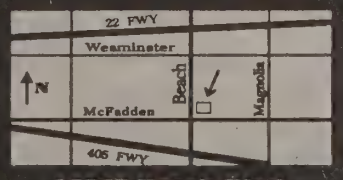

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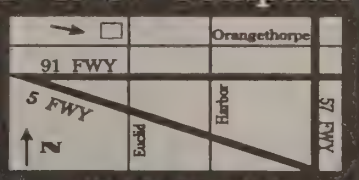

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Over thirty years ago Richard Feynman pointed out that physicists knew no limits to prevent us from doing engineering at the level of atoms.

conductive matter such as living cells to molecular (although not currently atomic) resolution.

Since then, every year has seen new inventions in the rapidly growing field of scanning probe microscopes. They're now imaging bits on magnetic surfaces, measuring temperature at microscopic sites, and monitoring the progress of chemical reactions. Recently, IBM San Jose used a scanning tunneling microscope to, in Feynman's words, put the atom right where the chemist says.

Here's a picture of xenon atoms on a nickel crystal, lined up in a row by pushing them into place with an STM tip. Remember, those bumps are individual atoms, and they've been moved precisely into position, in a row, one half nanometer from each other. [*Slide showing IBM spelled out using 35 atoms.*] You can not only put atoms right where the chemist wants them, you can put them right where the marketing department says to, as well.

Here, from the same paper, is a sequence of pictures showing a bunch of randomly positioned xenon atoms being aligned to spell out the name of the sponsor. Again, each dot in this picture is a single atom, and the letters are 5 nanometers tall.

Here's an illustration from a paper published a few weeks before the IBM result. The bottom picture shows an X drawn with an atomic force microscope on material adsorbed onto a zeolite crystal surface. The X is 8 nanometers tall, and it remained intact for the forty-five minutes it was monitored after being drawn there. This experiment was done with a desktop instrument no bigger or more complicated than a compact disc player.

MOLECULAR ENGINEERING

So what we're talking about is making the next big jump to building systems a thousand times smaller than the ones we're making today; to go all the way to the bottom and start working with individual atoms.

This is called molecular engineering, or nanotechnology. Eric Drexler defines this as control of the structure of matter at the molecular level, however achieved.

Technology has never had this kind of precise control; all of our technologies today are bulk technologies. We take a big chunk of stuff and hack away at it until we're left with the object we want, or we assemble parts from components without regard to structure at the molecular level. Precise atomic level fabrication has previously been done only by living biological organisms. We are entering an era when some of the barriers between engineered and living systems will begin to fall.

In fact, we're already building components on the scale of biological systems. The picture on the left shows a neuron net from a human brain with an integrated circuit component inset at the same scale. The picture on the right is a synapse—the interconnection of the wiring in the human brain, with a 1 micrometer scale. Remember that this is just about the feature size of the wires in our integrated circuits.

The huge difference in capability between engineered and biological systems is not just the materials from which they're made, it's that the fine structure of the integrated circuit stops with what you can see: there's nothing down below. Since we're forced to fabricate our circuits from bulk material, from the top down, they must be essentially two-dimensional. Biology builds its structures from the bottom up, at the molecular level, and in three dimensions.

Engineers are beginning to learn how to do this.

The challenges in scaling another factor of one thousand shouldn't be minimized. Developing millimeter, scale electronics and micrometer, scale integrated circuits wasn't easy, either, but after we overcame the initial obstacles, both progressed much faster and further than anybody initially expected.

The remarkable thing about molecular engineering is that it looks like there are many different ways to get there and, at the moment, rapid progress is being made along every path—all at the same time. In 1988, a group at Du Pont led by William DeGrado designed a new protein, called alpha-4, from scratch, and manufactured it in their laboratory. This protein, which never existed in nature, is more stable than natural proteins its size. Researchers around the world are now looking at proteins as molecular structures they can design and build, just as an IC designer lays out a chip.

Chemists are making progress in designing and synthesizing molecules that bind to other molecules at specific sites, facilitating the kind of self-assembly that occurs in biology. The 1987 Nobel Prize in Chemistry was awarded for just such work. I've already alluded to the feats accomplished so far with scanning probe microscopes. We now have a tool that lets us see and move individual atoms. STMs have also been used to pin molecules to a substrate and break molecular bonds. Eric Drexler [of Stanford] and John Foster of IBM have suggested in a recent paper in *Nature* that attaching custom molecules to the tip of a scanning microscope may allow assembling objects with up to ten thousand molecular pieces, with atomic precision.

The ability to model and simulate complex molecular systems has been growing rapidly in recent years, driven both by advances in raw computing power, but also by the development of better simulation techniques that now permit modeling of proteins composed of thousands of atoms.

Physicists and electrical engineers are making rapid progress in fabricating electron devices that work at the molecular level. In the past two years, Texas Instruments and Bell Labs have reported molecular-scale quantum transistors and have fabricated quantum wires with X-ray lithography. These quantum wires are on the order of 30 nanometers wide.

Materials scientists and mechanical engineers are fabricating new materials called "nanocomposites," made up of individual particles ranging from one hundred to one thousand atoms. These appear to have electrical and mechanical properties unlike any other engineering materials and may prove useful in the near future.

MOLECULAR ELECTRONICS

Even technologies with enormous potential can lie dormant unless there are significant payoffs along the way to reward those that pioneer them. That's one of the reasons integrated circuits developed so rapidly; each advance found an immediate market willing to apply it and enrich the innovator that created it.

Does molecular engineering have this kind of payoff? I think it does. Remembering that we may be less than ten years away from hitting the wall as far as scaling our existing electronics, a great deal of research is presently going on in the area of molecular and quantum electronics. The payoff is easy to calculate; you can build devices one thousand times faster, more energy efficient, and cheaper than those we're currently using—at least one hundred times better than exotic materials being considered to replace silicon when it reaches its limits.

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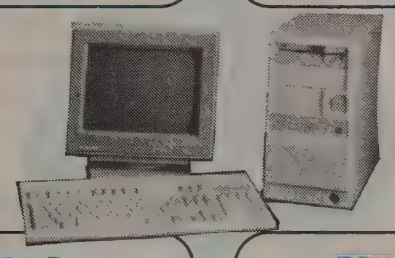

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As an example of current work, consider the molecular optical memory research underway by Prof. Robert Birge and his group at Syracuse University. Using the purple membrane from the bacterium *Halobacterium halobium*, they've made a working optical bistable switch, fabricated in a monolayer by self-assembly, that reliably stores data with ten thousand molecules per bit. The molecule switches in 500 femtoseconds—that's 1/2000 of a nanosecond, and the actual speed of the memory is currently limited by how fast you can steer a laser beam to the correct spot on the memory.

Lest you think this is some far-out distant future research topic, here's an ad from a couple weeks ago by a company in West Germany offering bacteriorhodopsin for sale, listing under applications, "Optical data processing, optical switches, holography, information processing, nonlinear optics, and light sensors."

SIXTH INDUSTRIAL REVOLUTION

And so, we can begin to see the outlines of the sixth industrial revolution: moving from micrometer-scale devices to nanometer scale devices. Current progress suggests the revolution may happen within this decade, perhaps starting within five years.

Neither the events nor their consequences will be subtle. Suddenly, we'll acquire new capabilities comparable to those of electronics or computers.

What can we make with it? Well, anything we can design and model that's built of atoms. Think about that. And that includes the essential component of the industrial revolution that will follow, perhaps in the same year.

SEVENTH INDUSTRIAL REVOLUTION

For once we've mastered the essential technology of life, assembling objects at the molecular level with molecular machines, there's no reason we can't rapidly exploit the central trick of life as well: getting the job done with machines that make copies of themselves.

Mass production has reshaped our industries, lives, economies, and societies, but it's been a limited form of mass production: one where the process of production was explicitly designed and rigidly oriented to making a given object.

Once we can build molecular machines, we can design machines that make copies of themselves. By doing so we achieve the second level of mass production: being able to make anything we can design at a cost fundamentally constrained only by the materials and information it contains.

If this seems absurd, just imagine how an engineer at the start of the twentieth century would have reacted to a description of photolithography, the technology we now use to make integrated circuits and printed circuit boards. "You're telling me you can manufacture objects in the millions just by making *photographs* of them? Give me a break!"

In fact, if we want to make objects on the meter scale with molecular engineering, we're going to have to design replicating machines. The vacuum tube I showed you has about 10^{23} atoms in it, and if you try to build something that large atom by atom, it's going to take pretty long. If you add an atom every second, it'll take 10^{23} seconds, which is a real problem because that's a million times longer than the current age of the universe. But, if you can get your molecular machines to crank out copies of themselves, you can set up a chain reaction that can generate numbers on that scale quite rapidly. That's how biology manufactures bacteria, butterflies, and buffaloes, and it works very well.

This is flexible manufacturing taken to the logical limit. An invention made on Monday could, by the following Friday, be in mass production, with billions of copies fabricated. It's the ultimate triumph of information over machinery, of software over hardware, of intellect over capital.

The consequences of this are truly hard to grasp. Just as the development of computers made many problems that have vexed mankind for centuries essentially trivial, we're looking here at the first fundamental change in the means of production in the last two million years. Our economic and societal structures have evolved around assumptions that will no longer be valid once technology reaches this milestone. And it may happen in the next ten years.

But the real question I haven't answered yet is this. "Is it actually possible to make these little tiny machines out of atoms and then get them to replicate themselves, or is this all just a pile of hooey, as ridiculous as, say, putting sixteen million transistors on a piece of silicon the size of your fingernail?"

Let's look at how we might design such a machine. Here's a little gadget that looks like a lunar lander, but considerably smaller. It stands about 225 nanometers high. This device is designed to operate within a living system, to seek out cells of a particular type, land on them by extending its landing legs, then inject them with material stored in the tank at the top.

You could design something like this, for example, to locate cancerous cells in a human body and kill them.

Here's our little machine attached to a cell, with its injector poked through the cell membrane and emptying the tank into the cell's interior. For a sense of scale, this entire gadget, standing on its tippy-toes would be less than a quarter the size of the smallest feature of a current microprocessor integrated circuit.

Could something like this be built? Could it possibly work?

Yes. Here's a scanning electron microscope picture of the actual device. It wasn't designed on a CAD system; it evolved in nature. It's called bacteriophage T4. It's a virus that preys on *E. coli*, a common bacterium that lives in the human intestine.

So molecular devices exist, work, and even succeed in replicating themselves in a proper environment.

Here's an electron micrograph of some *E. coli* cells infected with another virus, phage f2. The crystalline lattice in the corner of the cell is an array of self-assembled copies of the virus, manufactured within the cell.

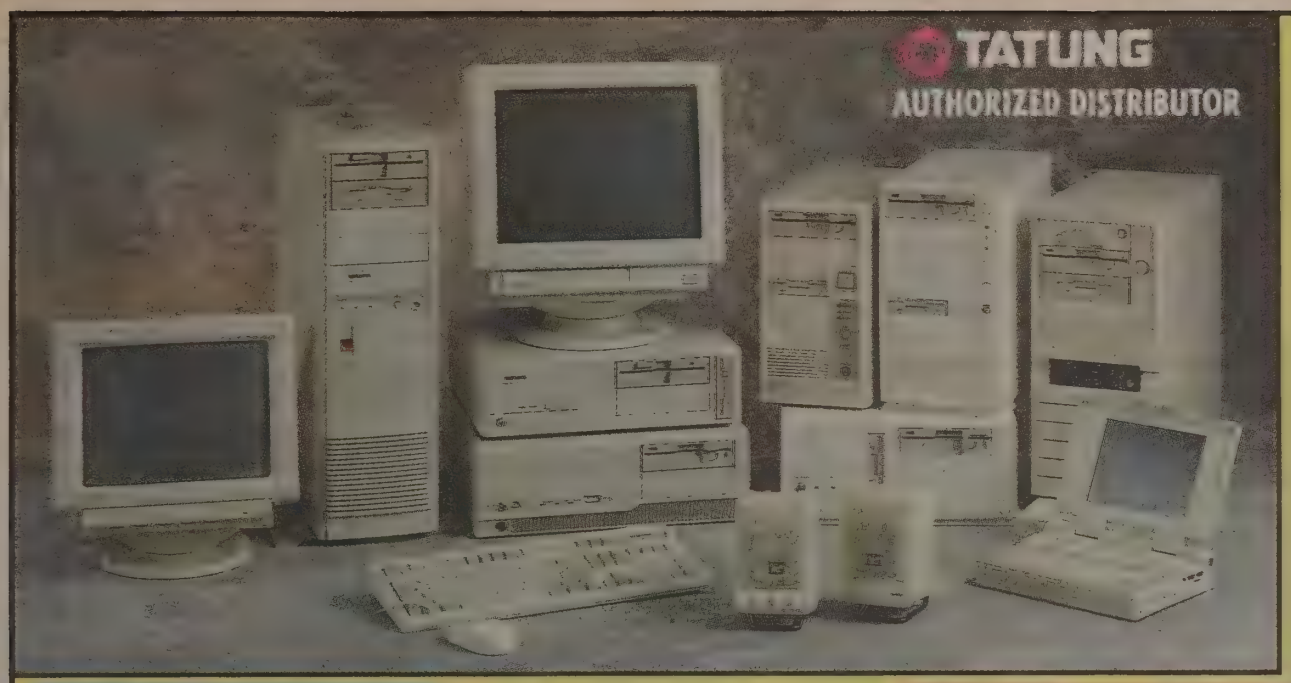
You might also ask, "Can we store information at the molecular level?" The answer to this is also yes, and each of us is living proof. Here's a picture of a molecular-level file copy operation in progress. This is a 140,000 times blow-up of a strand of messenger RNA being transcribed into the proteins it encodes by a bunch of ribosomes—they're the little beads on the string of RNA. The bumpy strings coming out the sides are the protein chains being assembled by the ribosomes. Each ribosome is a little molecular machine about 20 nanometers across that manufactures proteins to order by reading a tape called messenger RNA and assembling the protein it describes according to the genetic code.

There are quadrillions of them busy at work in each of your bodies at this very moment, and they're about as accurate in copying the molecular data in your DNA as a typical hard disc drive. Since these biological molecular machines obviously exist, and clearly work, and since biology follows the same laws of physics and chemistry we apply as engineers, there's no question our molecular machines will work. All we have to do is figure out how to design and build them.

And with the rapid progress on all fronts toward molecular fabrication, design may become the most important part of the puzzle.

THE ARGUMENT FOR DESIGN

The consequences of any industrial revolution extend far beyond the domain of scientists and technologists. Indeed, they are difficult to



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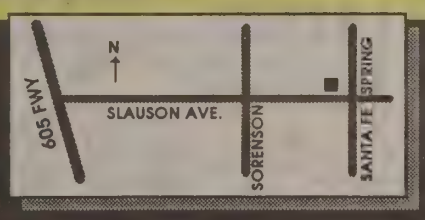

Precise, atomic-level fabrication has previously been done only by living biological organisms.

even imagine. For example, try to envision the present world without any electronic devices. You can't. Nobody can. It would be a very different world from ours.

Similarly, the world that will develop after the next two industrial revolutions is difficult to imagine starting from today, but there is every reason to believe the consequences of molecular engineering will be more profound in every way than those that followed the development of electronics or computers.

One thing, however, is clear. Unlike all of the industrial revolutions that preceded it, molecular engineering requires, as an essential component, the ability to design, model, and simulate molecular structures using computers.

Computer-aided design has been largely an adjunct to engineering so far. It has promised productivity gains, cost savings, and other benefits but except at the leading edge, as in VLSI design, has rarely been an indispensable component of the design process.

But with molecules, if you can't model it, you can't build it. Computer-aided molecular design is one of the key enabling technologies of these imminent industrial revolutions, and stands to benefit both by helping to bring them about, and to profit from the fruits of their success. A computer-aided design company that comprehends, throughout the organization, what is about to happen and takes the small, cautious, prudent steps today to position itself to ride this next wave, stands an excellent chance of emerging as one of the dominant industries on the planet as molecular engineering supplants our present technological base to the degree that integrated circuits have replaced vacuum tubes and electricity has displaced steam engines.

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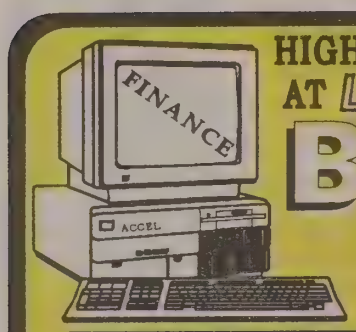
The lever pivots on the micrometer technology of the microprocessor. At one end, we reach to grasp it with our meter-scale human hands, at the other, it manipulates atoms to designs born of the human imagination. With this lever, and the knowledge, courage, and vision to operate it wisely, we can truly move the world. ■



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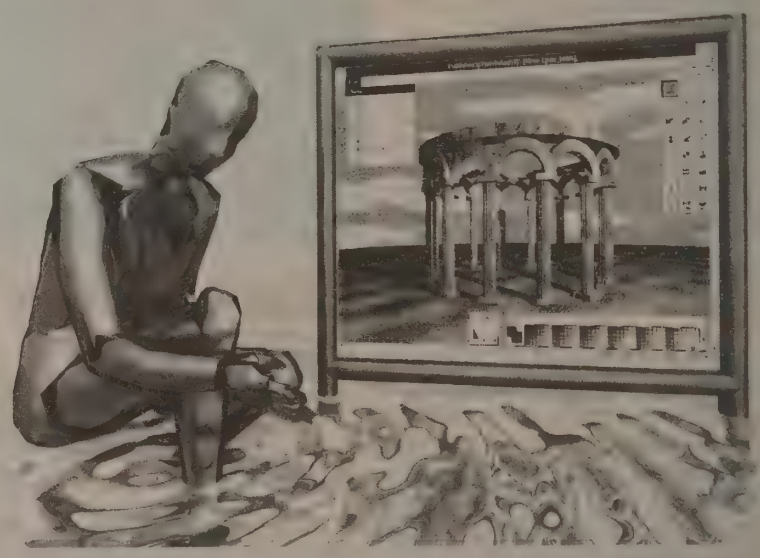

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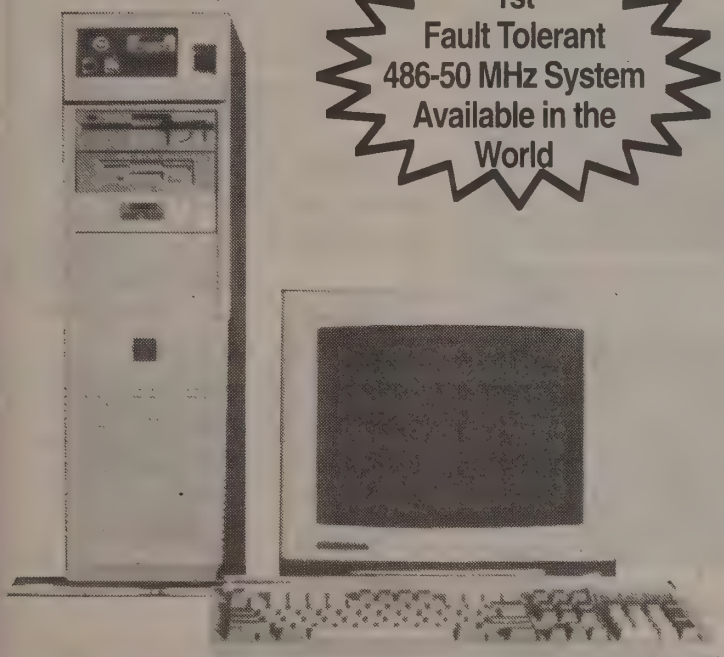

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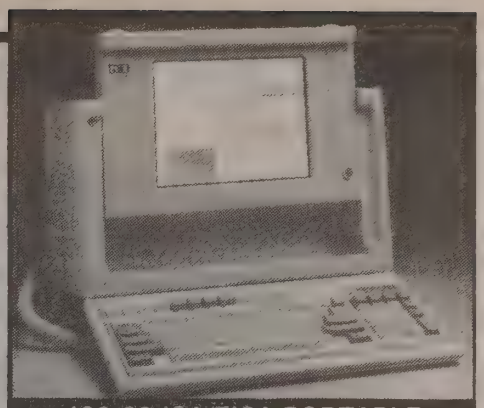

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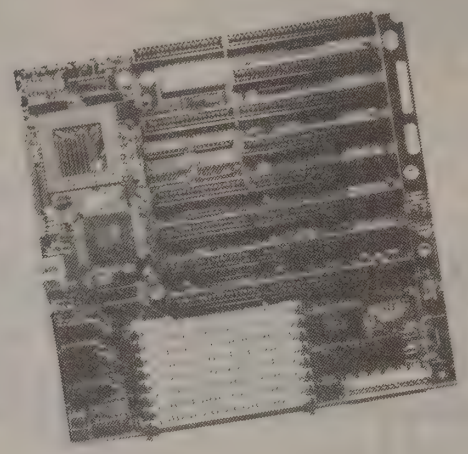

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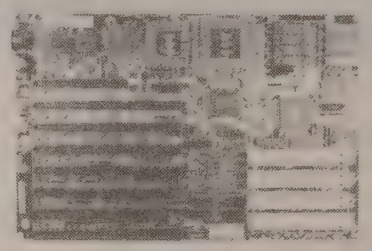
Software	Version	386-40	*486SX-25*	Unit
Power Meter	I1.7	8.6	*11.1*	MIPS
Landmark	V1.14	64.9	*113.2*	MHz
Checkit	V3.0	9747	*12054*	Dhystones
Qaplus	V4.52	11379	*15172*	Dhrystones
Cache Size		64K	*0K*	Byte
Cost With CPU *		$175	*$175*	USD

*Estimated in July, based on minimum quantity of 100 units.

Let's talk about boards,



CPU:80486-50
CHIPSET:SIS
CACHE:64/128/256/
512KB/1MB
BIOS:AMI
BOARD SIZE:BABY
SLOTS: 8

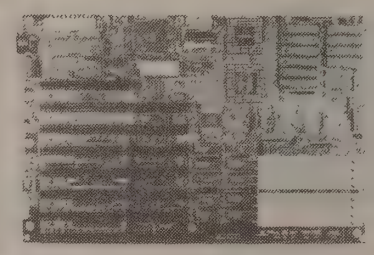
486DX-50(AT450)

CPU:80486DX2-50/66
CHIPSET:SIS
CACHE:64/128/256/
512KB/1MB
BIOS:AMI
BOARD SIZE:BABY
SLOTS: 8

486DX-33;SX-25/ 20(AT433)

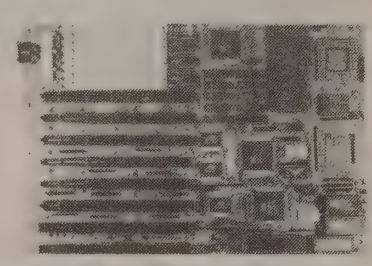
CPU:80386-40/33/25
38605-40/33/25
CHIPSET:CHIPS AND TECH.
CACHE:64/128/256/
BIOS:AMI
BOARD SIZE:BABY
SLOTS: 8

386DX-40/33/25(FU333)



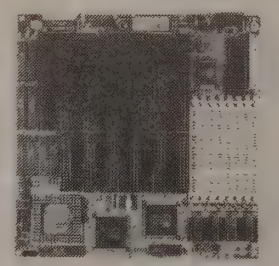
CPU:80386-40/33/25
CHIPSET:SIS
CACHE:64/128/256/
BIOS:AMI/AWARD
BOARD SIZE:BABY
SLOTS: 8

386DX-33/25(FS333)



CPU:80486-50/33
CHIPSET:SIS
CACHE:64/128/256
BIOS:AWARD
BOARD SIZE:BABY
SLOTS: 8

486-50/33 EISA(AE4)



CPU:80486DX2-50/66
CHIPSET:SIS
CACHE:64/128/256/
BIOS:AMI/AWARD
BOARD SIZE:HALF
SLOTS: 7

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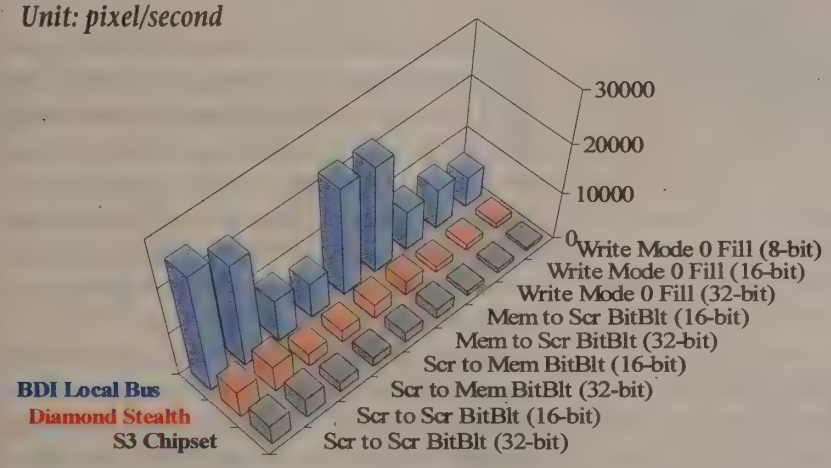
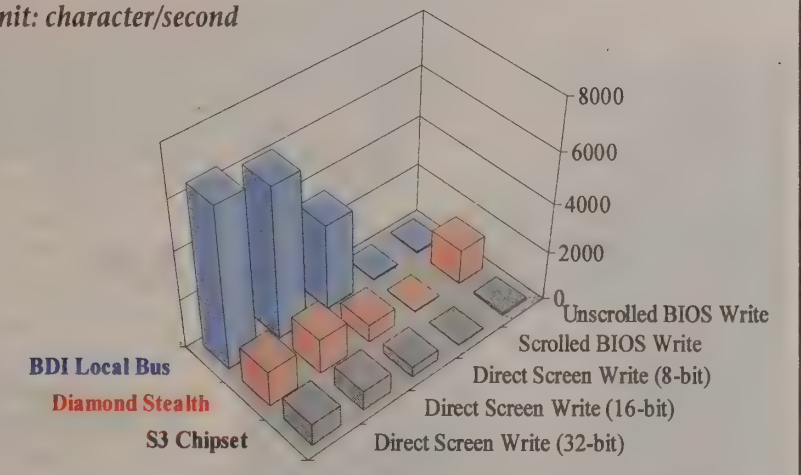


Text Performance Comparison
Unit: character/second



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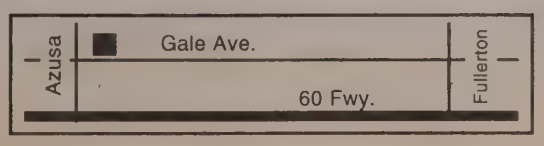

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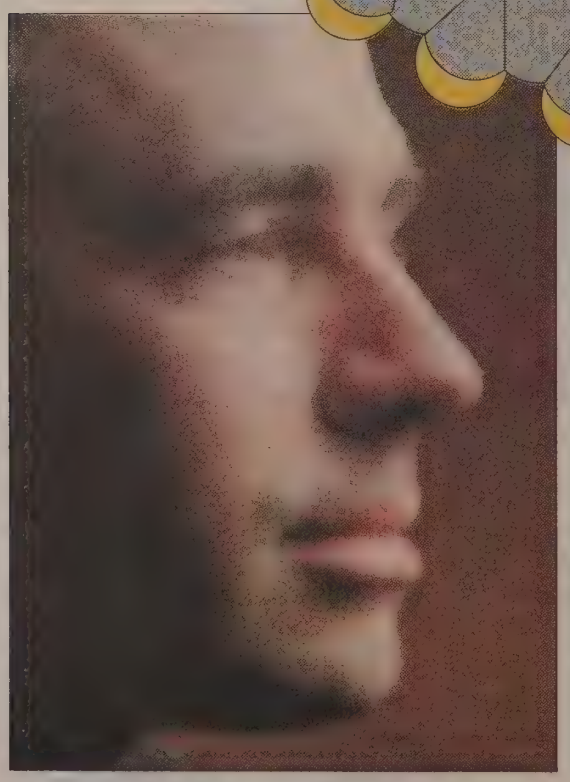
Cross section of a nanometer-scale planetary gear, designed by Eric Drexler and Ralph Merkle.



AN INTERVIEW WITH ERIC DREXLER

Back in the 1970s, while an undergraduate at MIT, Eric Drexler read about the advancing state of research in molecular biology, where, he says, "researchers kept discovering new molecular machines within organisms and studying how they worked. I began to wonder what kinds of things we'll be able to build when we have tools we don't have yet, tools able to build molecular machines."

Not without a fair amount of struggle for acceptance in academic circles, Drexler ultimately received a Ph.D. in Molecular Nanotechnology from MIT, and is currently a Research Fellow of the Institute for Molecular Manufacturing. He is also the president of the Foresight Institute, a Palo Alto-based nonprofit educational organization founded, as he explains it, "to gather, digest, and distribute information on molecular nanotechnology and related advanced technologies, discussing both what's happening in the laboratory today, what the pathways are, what the long-term technological capabilities are, and the consequences for policy and decisions that need to be made."

HNOLOGY

Myth From Reality

BY MARY EISENHART

PHOTOS: GLENN MATSUMURA

Since Drexler's first book, *Engines of Creation* (Doubleday), first appeared in 1986, nanotechnology has garnered enthusiastic interest (and equally vigorous nay-saying) in the technical and scientific communities. It has also brought on a bizarre assortment of half-baked speculation, snake oil, and pie-in-the-sky schemes.

This, Drexler points out, is only natural for discussions of products likely to be decades away. And while the inevitable onslaught of flakes and charlatans is a known road hazard on the technological highways—particularly when sober scientists discuss nanomachines dedicated to killing cancer cells or reversing the aging process, or food production reminiscent of the have-it-your-way gizmos on *Star Trek*—it need not detract from useful study.

"It's very important to distinguish between what is near-term and what is long-term," says Drexler, "and also between what's real and unreal. And to not confuse 'long term' with 'unreal,' which is a classic American disease."

While in the United States, there is little funding (public or private) committed to research in the field, the situation in Japan is quite different, with MITI announcing last year a commitment of $185 million to nanotechnology research, and the Science and Technology Agency funding research projects aimed at building complex structures, atom by atom. One such project, the Aono Atomcraft Project, has been taking a hands-on approach that parallels theoretical studies by Drexler and Xerox PARC researcher Ralph Merkle, but, says Drexler, "Aono has funding and a laboratory. Ralph and I are both doing theoretical studies—studying what kinds of systems can be built in the long term, and how to get there. Which is different from taking steps in a laboratory along one of these paths. And also much less expensive!" he laughs.

"I don't know of any people who have looked closely at molecular manufacturing, and understand the physical mechanisms involved and the analysis behind it, who are not of the opinion that, yes, this is going to be a dominant manfacturing technology in the twenty-first century. Certainly that it's going to be used to make computers. Quite likely that it's going to be used to make a much

I expect in the ultimate destiny of this that there's going to be an appliance that sits on your desktop that can make anything. I don't expect that to happen within the lifetime of AutoCAD Release 13 or 14. But that's where it's all going.

This week we're shipping HyperChem, which lets you design objects at the molecular level. The technology is going to go on scaling down until we have the same level of fine-grained control over the structure of matter that biology has been using for the last billion years or so. And at that point, we're going to be able to make anything *from a digital model.*

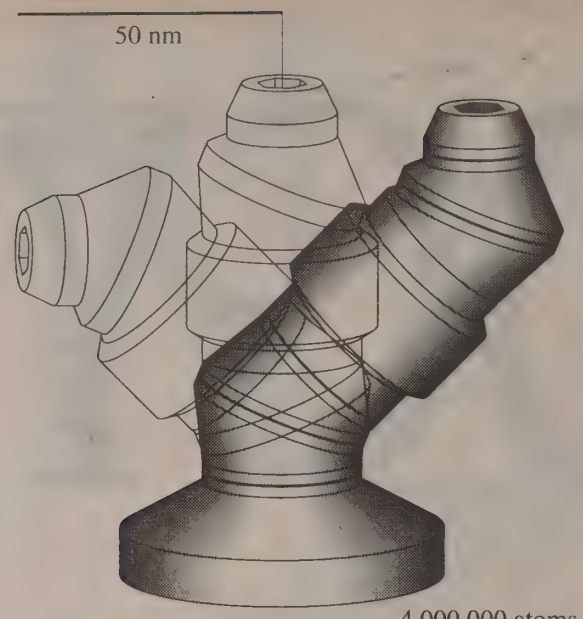
That's going to change the world, beyond comprehension, I think.

—John Walker, MicroTimes #95

Imagine that many of the key developments of twentieth-century technology were consequences of something that could be figured out in the nineteenth century, but still would take many years to implement. So in the nineteenth century, someone was able, not to understand the whole of the twentieth century, but to understand that it would be possible to develop antibiotics, nuclear weapons, and farm technologies that made it possible to feed the population with only a few percent of the population working in agriculture. Let's say that this was determined at a time when most people were farmers, when infectious disease was a dominant cause of death, and when no one had any concept that it was possible to destroy the planet.

One could imagine a range of scenarios where the ability to have food without people working on the farm produces unimagined wealth and leisure and is portrayed as Utopia. One can imagine the existence of nuclear weapons being portrayed as a sure recipe for our immediate obliteration, and the idea of penicillin eliminating a wide range of infectious diseases as a fantasy—"a pill that cures all these things?"

The reality has been much more complex than any of those views, and much of what has happened would have been rejected as a fantasy at the time. Indeed, many correct predictions at various times were rejected in just that manner. I think that's a useful comparison to judge what's being said now, and how it may be compared to the eventual reality.



"The things that molecular machines do in biology include taking molecules and putting them together in complex patterns to make other molecular machines. A wide range of products—everything from protein molecules to redwood trees—is made by biological molecular machines."

broader range of products," says Drexler. And the Japanese, historically more concerned with the long term than the quarterly bottom line, are putting significant resources into nanotechnology. "Rather than seeing twenty years as forever, they see it as a fraction of a human lifetime, as planning for one's own personal future, for that of one's friends and relatives and children."

So, for now, Drexler and his colleagues are engaged in research and information dissemination, taking the small steps along the path to a radically different future. In November, the Foresight Institute will present the First General Conference on Nanotechnology: Development, Applications, and Opportunities in Palo Alto. The conference lasts three days and features discussions of issues ranging from "Intelligent Computation in the Age of Molecular Manufacturing" by MIT's Marvin Minsky to "Designing Molecular Components" by Ted Kaehler of Apple Computer to "Nanotechnology R&D Sponsorship" by Neil Jacobstein of Cimflex Teknowledge.

For the last 4½, Drexler's been working on the just-published *Nanosystems: Molecular Machinery, Manufacturing, and Computation* (Wiley-Interscience), a college-textbook-level work intended to serve as a foundation for the studies of future researchers in the field. In 1991, he and coauthors Chris Peterson and Gayle Pergamit published *Unbounding the Future* (Morrow), which explores, at a level accessible to a nontechnical audience, the basic concepts and social implications of nanotechnology.

With a view to similar exploration, we recently paid Drexler a visit.

What do you mean by "nanotechnology"?

Since 1986, it's become a buzzword in science and technology, but it has been applied to anything on a nanometer scale, rather than to what I've been terming here "molecular manufacturing."

There are two basically different approaches to making small structures. One is the top-down approach that's been followed in the semiconductor industry, where you use large machines to make small features, and you strive to make smaller and smaller features every year, while still keeping enough control of the shape of those little irregular structures that they do what you want. The payoff from this has been enormous; that path has a considerable distance to go, and the computer capacity that results will contribute greatly to the development of molecular nanotechnology.

But molecular nanotechnology itself moves in the opposite direction. It starts with small, precisely structured molecules, which people have been making for a hundred years or more through organic chemistry. And the challenge, rather than making things smaller, is to make things larger, while keeping that precise control.

So molecular nanotechnology is a bottom-up path. Conventional microtechnology, which has recently been relabeled with the sexy term nanotechnology, is a fundamentally different top-down path that I don't think leads to the same destination.

I see them as moving together on a size scale, and having some synergy. I can imagine hybrid systems for a time. But then the molecular approach, I believe, will displace the other, because of its advantages of precision, range of control, and cost. Nobody's ever suggested to me how anything else could substitute for it.

Molecular manufacturing, which is at the heart of molecular nanotechnology, will be based on the use of molecular machines that use molecules as building blocks to build complex structures.

Explain "molecular machines."

A conventional machine is a large collection of atoms with parts that move and do useful things. A molecular machine is one that has very few atoms, relatively speaking—thousands or millions or billions are typical numbers—and that has all its atoms in precisely defined locations as an aspect of its design and manufacture. So they're devices that have scales measured in nanometers instead of millimeters, which makes them roughly a factor of a million smaller than conventional mechanical devices.

The things that molecular machines do in biology include taking molecules and putting them together in complex patterns to make other molecular machines. A wide range of products—everything from protein molecules to redwood trees—is made by biological molecular machines.

Studying what could be done with artificial molecular machines led to the conclusion that they could be used to build better molecular machines that could be used to build better molecular machines that could be used to make—it's a slight exaggeration to say "anything that's physically possible by arranging atoms," but surely a much, much wider range of physical structures than can be made any other way.

In the 1970s, genetic engineering technology was just getting underway. This made it possible to synthesize, more conveniently than before, new protein molecules. Proteins serve as components of molecular machines in biology, and that meant that the problem was one of design. We had the tools to make building blocks for molecular machines; the challenge was to design them.

So in 1981 I published a paper in the *Proceedings of the National Academy of Sciences*, arguing that protein design was in fact feasible—many people at the time thought that it was impossible because of the complexity of different ways that a long, floppy molecule could fold up—and then presenting an analysis that indicated that with protein-based molecular machines, you could start this process of building better molecular machines, and eventually have very sophisticated molecular manufacturing systems.

And in fact in 1988, a protein molecule was successfully designed from scratch, by Bill DeGrado at DuPont. A number of groups have done likewise since.

Unfortunately, this work has not been done by people with a systems engineering perspective, and so little or no effort has gone into making building blocks for larger systems. It's been done by biologists and chemists, who are chiefly interested in studying natural systems by imitating them, with small differences, and in making devices that do what we see in nature, perhaps under different conditions.

For example, proteins have been engineered for

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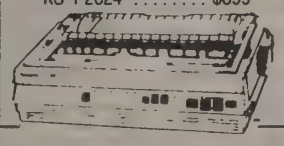

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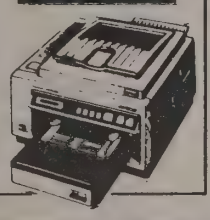

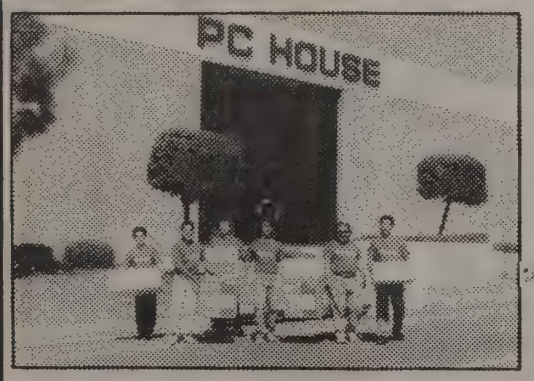

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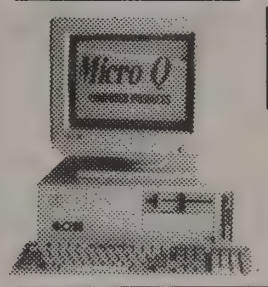

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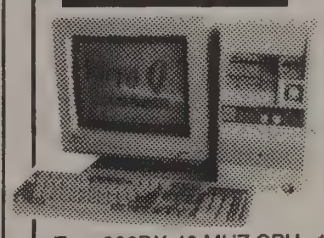

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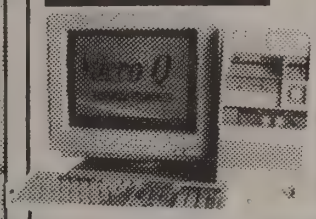

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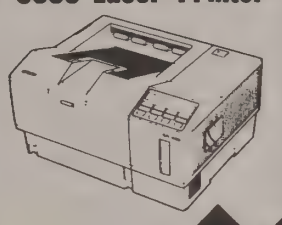

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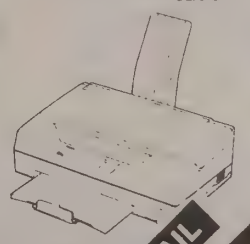

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greater stability, to enable them to sit in bottles of enzyme detergent on shelves in grocery stores for a long time.

So what do engineers contribute?

Engineers bring an understanding of the principle that a set of building blocks and a way of putting them together can be used to make systems of indefinitely large size and complexity.

We see in computers that knowing how to make a few kinds of transistors and connections between them is sufficient to make the most sophisticated supercomputers in the world, or at least the CPUs for them. We see in software that a few instructions in a RISC machine can be used to implement absolutely any computational process. And that understanding, applied to the molecular domain, can open a new world of engineering.

In some ways the development of molecular manufacturing will be like the development of the digital computer. Once upon a time, there were many different special-purpose devices for processing information—adding machines, and analog computers, and so on and so forth. Then there was the development of a general-purpose device for processing information that worked by handling information in what could be seen as its fundamental units—bits—performing repetitive operations in a controlled sequence at high speed, using smaller and smaller devices.

In conventional manufacturing today there is a wide range of special purpose devices—milling machines and lathes and injection molding machines and so forth—but what we can look forward to is the development of a general-purpose device that can make virtually anything by working with matter in terms of its smallest building blocks, atoms and molecules. And again, working at high speeds, using small devices performing simple repetitive operations in a controlled sequence.

What kinds of products and technologies might come out of this?

The easiest products to imagine just offer large performance improvements over ones that we already have. For example, we've seen computers for many years now become smaller and faster and more energy-efficient. With molecular manufacturing, it will be possible to make machines that are somewhat faster—billion-cycle-per-second clock rates—that are smaller than a bacterium, and consume so little power that a billion times the capacity of a modern supercomputer could be put in a desktop box and cooled with a fan. The reason that these devices are only somewhat faster than modern electronics is that this particular calculation is based on a simple mechanical scheme, a hybrid between Babbage's Analytical Engine *[laughs]*, modern VLSI architectures, and molecular components.

Ralph Merkle at Xerox PARC and I have been looking at electronic schemes for computation that would likewise exploit nanometer-scale components built with molecular precision.

Most of the work that Ralph and I have been doing, though, uses the standard computational modeling tools that chemists have developed to predict the behavior of the molecules they're working with, and applies those tools to describe large structures that are designed to work like macroscopic machine components. Things like robot arms in factories—for an example that's highly relevant to molecular manufacturing—have gears and bearings and a wide range of moving parts. So Ralph and I have designed a set of bearings with hundreds to thousands of atoms—the principles scale up to larger structures—and more recently have designed the first nanometer-scale planetary gear system, a device that has a shaft coming in one side spinning it at one speed, and a shaft coming out the other side that spins at a different speed, and transmits power from one to the other.

What might this gizmo be used for?

This particular device is primarily a demonstration of what can be designed and modeled with available tools. But planetary gears are found, in the macroscopic world, in automobile transmissions, and in nanometer-scale mechanical systems they can serve similar functions.

What separates the designing and modeling, which you can do with current molecular modeling technology, as I understand it, from the ability to actually build the things?

What we've been designing are things that can't be built with anything like today's tools. They can be modeled, in part, because they contain very few atoms and therefore are among the simplest mechanical devices that are possible in the physical world.

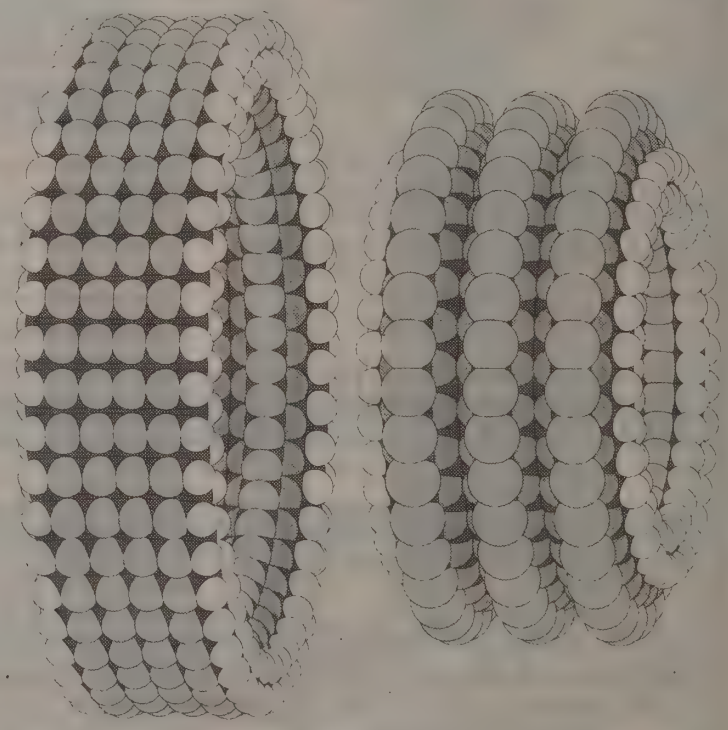
But to make them will require tools that can position very reactive molecules precisely in three-dimensional space, to build up these structures in more or less a building-block fashion. Those tools don't exist, but we can see how to go about developing them in a step-by-step fashion. It will take many years.

What is the current state of tools? It is now possible for people at IBM to line up a bunch of atoms to spell IBM. But as I understand it, this is done at very, very low temperatures, and when you get to room temperature the atoms go about their normal business... So this is transitory and expensive and not currently useful.

The next major step on the pathway that currently seems most attractive involves using a relative of the scanning tunneling microscope (which was what Don Eigler's group used at IBM Almaden), the atomic force microscope [AFM], as a positioning mechanism for reactive molecules, molecules that, when put in place, will form strong, stable bonds to their neighbors.

Markus Krummenacker, a researcher supported by the Institute for Molecular Manufacturing, is presently studying the design of molecular building blocks with those properties. And research is getting underway here in the Bay Area aimed directly at building an instrument able to position such building blocks, a descendant of the atomic force

"What we've been designing are things that can't be built with anything like today's tools. To make them will require tools that can position very reactive molecules precisely in three-dimensional space, to build up these structures in more or less a building-block fashion. Those tools don't exist, but we can see how to go about developing them in a step-by-step fashion. It will take many years."



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microscope. This instrument, as planned, will be an adaptation of the atomic force microscope.

The atomic force microscope can act like a robot arm, able to position things in three degrees of freedom, not rotating, but X-Y-Z. What has been lacking is the functional equivalent of a hand at the end of the arm. It's like a robot arm that ends in a rough rock, rather than a selective gripper. A suitably attached protein molecule, in particular an antibody fragment, can serve as a selective gripper for other molecules.

This family of technologies can initially be used as an improved atomic force microscope—rather than bumping a blunt rough object against something to probe its shape, you can bump a sharp, precisely defined molecule against something to probe its shape, and can in fact probe it with several different tips, one after another.

This promises to be a powerful tool for biological studies, and for the pharmaceutical industry, as soon as it can be developed, and without building anything else. So that will, I believe, help to fund the development of the technology base, but that same instrument, by positioning reactive molecules, can build things. And the question is, what?

The first set of applications will be molecular instruments, made by building a complex molecular structure that's comparable in size to a protein molecule, or a set of protein molecules. That, for example, reads DNA—the DNA molecule binds, and feeds through the structure, and is destroyed one step at a time. If you can probe the DNA molecule as it goes by, so that you are reading out the sequence, you would have a molecular DNA reader. We know that molecules can read DNA, because that's how DNA is copied; the challenge is to build a device that reads DNA, and instead of producing a copy, produces, through a suitable interface, a pattern in computer memory.

This data could be used to learn about the molecular mechanisms of healthy tissue and of disease processes, and would be an aid in medical studies and pharmaceutical design, as well as in basic biology. If you can easily map all of the genes in a normal cell, then all of the genes in a cancer cell, you're going to more easily learn what the genetic changes were with that particular cancer. And from there, you'll have made at least a step in learning how to deal with it.

One of the scenarios in *Unbounding* is that of taking a pill of little nanomachines that attack only your cancer cells. How realistic is that? How do you separate the snake oil from the reality when you're at such an early stage? Some people would have it, for instance, that nanotechnology will enable us to live forever...

Well, first, it's clear that the ability to build sensors and medical instruments at a molecular scale, and to guide them using computers that are themselves smaller than a cell, will open a new world of medical capabilities. It will bring surgical control to a molecular level. What that can mean for treating disease is extremely broad. What it can mean for reversing the molecular and cellular changes of aging is also very broad.

But when people speak of immortality, they're speaking of something that can't be achieved within physical law as we understand it, because nothing is permanent and indestructible.

This spring I heard you say that when you first got interested in this, it seemed like a very, very long-term thing, and then relatively recently enough progress has been made to make you think that some of it, at least, is fairly short-term.

Over the years we've seen both an improvement in the technology base—the ability to make molecules and the ability to maneuver physical objects with subatomic precision. That's come out of laboratory work in the rest of the world.

In my own work over the last several years I have begun focusing on the question of the first steps. My initial studies were of long-term capabilities, which in many ways are simpler than first steps, in much the same way that digital logic is simpler than complex nonlinear transistor circuitry where you're paying attention to all the messiness of what's going on in those circuits.

Studies of those questions, taking advantage of recent developments in the technology base, indicate that there are impressive advances that can be made with something on the order of one year of laboratory effort, involving just a handful of people and relatively inexpensive equipment. And that there are a series of steps of increasing expense and difficulty as one builds more complex systems that lead from there to advanced molecular manufacturing of a wide range of products. With payoffs at every step along the way.

It appears that a first generation of scientific instruments based on improved atomic force microscopes can be developed in a time frame and cost range that is standard for venture capital. A few years, and a few million dollars.

Those instruments would then be very useful in biomedical research and pharmaceuticals, and would have a market that's substantial compared to that initial investment.

That same technology base, with moderate extensions, can be used to build complex molecular structures by positioning reactive molecules. Development can be rapid, because the time required to do an experiment to find out what's wrong with it and try again is short, on the order of a day. And the instruments required to do that are expected to be in the cost range of a high-end workstation. And so it's reasonable to expect that a wide range of moderately complex molecular mechanical devices can be built in a moderate length of time with a moderate development cost.

That range of devices includes a yet broader class of scientific instruments—I gave you the example earlier of a DNA reader. That's the most obvious one, and I suspect that as we get closer to that time and look more closely, a wider range of molecular scale instruments will appear attractive.

The reason for focusing on scientific instruments is that the value of information is independent of the size of the mechanism that produces it. Information about molecules that are found in the human body or that are used in industry in the million-ton-per-year range can be very valuable, even

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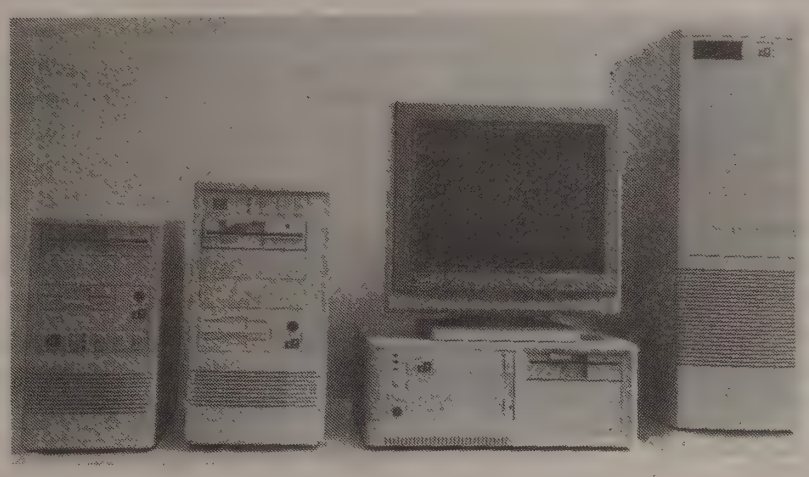

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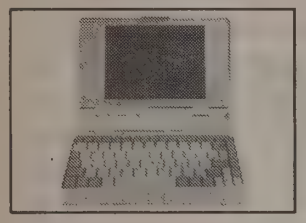

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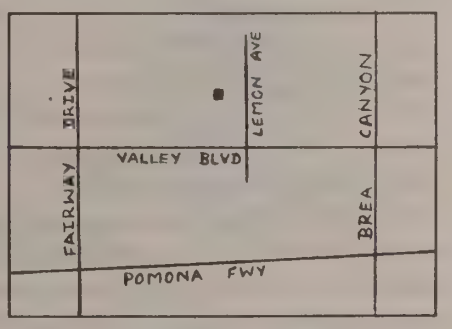

if that information was gained by studying just one molecule. So building a single molecular instrument can yield information that's worth thousands, millions, in some instances billions of dollars.

Pursuing that development path leads to a technology base able to build fairly complex molecular machines. Design analysis indicates that a mechanism with roughly one hundred moving parts is complex enough that with broadcast acoustic instructions to make it step through a series of states, it could be used much as the AFM mechanism could be used, as a construction mechanism, to build things. And since it itself would have been built by the AFM mechanism, one of the kinds of things it could build is more devices of the same sort.

At that point, you're in a position to make products from chemicals that have some cost that doesn't look ridiculous when expressed in dollars per gram, and is extremely small when expressed in dollars per molecule, since there are many billions of billions of typical molecules in a gram. At a thousand dollars per gram, you're talking about much less than a nanodollar per molecule. *[laughs]*

If you can produce complex structures from those building blocks for that kind of cost per gram, the cost per device is many orders of magnitude smaller than what is possible with semiconductor lithography and the integrated circuit technology on which computer electronics is based.

At that point it's reasonable to expect that someone will design devices that can serve as RAM storage cells, and will do the engineering work necessary to build RAM systems in which these molecular devices serve as storage cells. At that point a reasonable thing to anticipate is memory devices that use a semiconductor chip as an addressing mechanism, and a layer of repetitive molecular devices on top of that—a slab consisting of many layers of molecular devices on top of that, such that bits could be read from any of the molecular blocks on the interior of the slab. We're not talking a few atoms, or a few thousand atoms, but perhaps a few million per block.

Nonetheless, reasonable storage capacities for a device like that are in excess of 10^{15} bits in a chip-size package.

Compare that to what's currently available, or planned.

There is talk today of billion-bit chips. This would be a million times that capacity. And it's possible to do much, much better than that. What I described is a sketch of what one might see as an early-generation hybrid system.

The direction from there leads to building larger and more complex structures with molecular precision, including CPUs, and denser memory systems that are not limited by addressing through a chip, but instead have all of the required devices implemented on the molecular scale.

And at that point the hardware technology base for computers has been replaced, and we're clearly speaking of a many-billion-dollar world-class industry. In that same time frame, a wide range of other applications can be expected, but I think that example is sufficient to show the scale.

What time frame do you think that's likely to be? Two years? Five years? Twenty years?

Dates are difficult to estimate. It's much easier to calculate a good approximation to the behavior of a molecule than it is to make even a rough estimate of what a world full of researchers will do over a span of years when they're developing new tools and pursuing diverse goals.

But keeping that in mind, it is easy to see how to get a first-generation molecular manipulator with what a number of laboratory researchers have independently told me looks like a few months of work, for a crude prototype that demonstrates the principles. Developing that into a capable system and learning to use that well for molecular construction might take five years. At that point it's plausible that you could make machines with a hundred moving parts.

With machines with a hundred moving parts, you can now build a molecular-scale device, a hundred-nanometer-scale (tenth-micron-scale) device that is doing molecular construction, and you're in a position to begin a multi-year development effort that leads to making macroscopic quantities of increasingly complex products.

To reach the threshold of advanced molecular manufacturing, able to build a very wide range of kinds of materials and structures, will require another layer of advances on top of that. Again with fast, inexpensive experiments at each step along these paths, it's plausible that another five years, with at the later dates large resources being poured into what is already a very useful technology, could lead to these kinds of advanced results.

If you add up that sequence of steps, it adds up to fifteen years, but I wouldn't place any great confidence on that number.

Where do computers as we currently know them fit in with this, as tools or otherwise?

Microcomputers are used to control scanning tunneling microscopes and atomic force microscopes, to capture the data from them, to process that data into images. Increasingly in coming years, I would expect to see more powerful computer capabilities being applied to the interpretation of those images.

That will be important as molecular nanotechnology is developed, because the cycle of experimentation will involve trying to perform an operation and then probing the product with the point to determine what happened. Software for very rapidly and reliably interpreting those images will play a major role.

The other major application is in molecular CAD. Ralph Merkle has been developing software that can be used together with the chemists' standard modeling packages to help design the structures that the other package models, and at this point he has quite a long wish list of capabilities that they're beginning to work on.

What is the distinction between designing and modeling?

In molecular design you decide what atoms go where, what is the pattern of atoms and bonds that makes the shape that makes the structure of the component. In modeling you take that design, which is basically just a drawing—and then you turn on physics, or at least you turn on an approximation to the physics of real molecules, and as a result things move around, it all relaxes to a minimum-energy state. In other applications of modeling you can turn on thermal motion, and now the atoms move around subject to the forces that approximate the ones they would experience in a real molecule, so you can watch the dynamical behavior of the system.

So this is in a sense mechanical engineering on a completely different scale from what we're used to.

This is *precisely* mechanical engineering, in which something like finite-element approaches come naturally because there are a distinct number of atoms, though it's mathematically rather different from finite-element analysis.

One thing I've picked up over the last few months is that all this molecule-manipulating is happening at very cold temperatures, and once you get to something like room temperature all the molecules go on about their usual business. So how do you deal with things like turning off heat? How do you isolate what you want to do?

That's a set of questions that has different answers in different contexts. The first in a long series of steps will involve having a lot of stray molecules around that you don't want, having all the problems that chemists have with choosing molecules that will react and trying to surround them by others that won't react if they're not supposed to.

Today, chemists successfully make things by what is the equivalent of throwing parts in a box and shaking. What these AFM-based molecular manipulators will provide is the equivalent of a hand to put parts together. You'll still have other parts shaking around, but you'll add to the process a hand. There are a lot of limits to what you can do with that, but it's a big advance over where we are.

At the end of a long development pathway, what is described in *Nanosystems* is macroscopic systems that have a gas-tight wall around them. There are no stray molecules inside; the only molecules inside are ones that were brought in there after several steps of sorting and testing. They're bound firmly, and they go where you want them to, subject to only very small deviations due to thermal vibration. They can't wander, they can only vibrate within a small range, and that range can be small enough that they end up where you want them.

This is at the end of a long series of developments. This is where you are many years from now with a lot of work.

In one of your papers you talk about how there is not, at this point, a formal academic discipline called nanotechnology, and you talk about what somebody can study at this time to acquire a good background in the field.

I would say that some of the more relevant standard academic backgrounds are in physics, chemistry, mechanical engineering, and computer sci-

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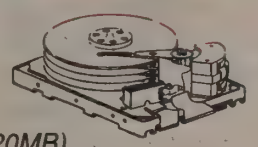

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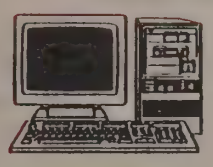

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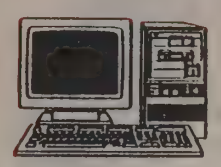

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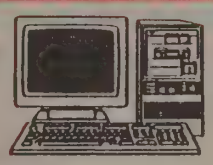

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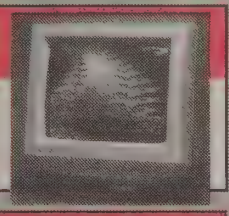

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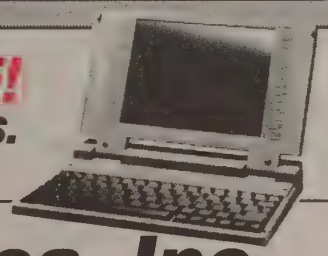

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ence. Molecular biology has some substantial relevance, particularly if there's been a focus on the molecular mechanisms involved. A lot of molecular biology is at some remove of abstraction from the nuts-and-bolts physical level.

I just spent 4 1/2 years working on *Nanosystems,* and giving it the content that it has, for the purpose of enabling people with backgrounds in those areas to learn what is necessary to analyze and design molecular machine systems, or to develop software to aid in design and analysis, or to gain enough understanding of their capabilities that it's possible to think more concretely about what can be done with them. My hope is that that will be useful for people who are interested in working in the field.

Molecular nanotechnology is a strongly interdisciplinary field. The fundamental interactions are chemical, but they need to be analyzed in a way that has more in common with the way physicists think of things than the way most chemists think of things. But the systems to be built, and therefore much of the analysis of what kinds of things to design, are primarily a matter of mechanical engineering.

This has led to two problems in the academic world. In the United States at least, chemistry, including synthetic organic chemistry, which is about making new molecules, isn't taught as a kind of manufacturing, or indeed as any branch of engineering and construction; it's instead taught as a natural science. At the University of Tokyo, in contrast, the Department of Synthetic Chemistry is in the school of engineering.

So this is an engineering discipline which is founded on the molecular sciences, but people in the molecular sciences, by and large, do not know how to think as engineers. Some do, but it's far outside the mainstream of the culture. That has led to difficulties.

And also, deeply rooted in chemistry as practiced today is the assumption that molecules are small and that they move around freely and run into each other in all possible positions and orientations, and that if a reaction is possible in any of those positions and orientations, it will happen. That tremendously limits the building blocks you can use and what you can do with them. A physical system in which those same molecules move in a controlled way and only encounter each other as planned, and can then be pushed together—that seemingly simple change upsets a tremendous number of usually unexamined assumptions in the field, even though there is nothing fundamentally novel about it in a scientific sense. And that's led to a whole pattern of superficial misconceptions.

For example, looking at a proposed structure and saying, "That structure is unstable." What's often meant is, "If that structure were to run into another identical structure in a particular position and orientation, then those two copies of the same structure would react." That doesn't arise in the context of advanced molecular machine systems, and in that context such a structure is stable. But a quick glance would suggest to a practicing chemist that whoever

continued on page 161

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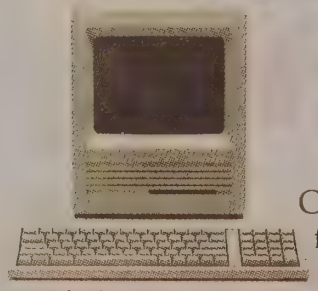

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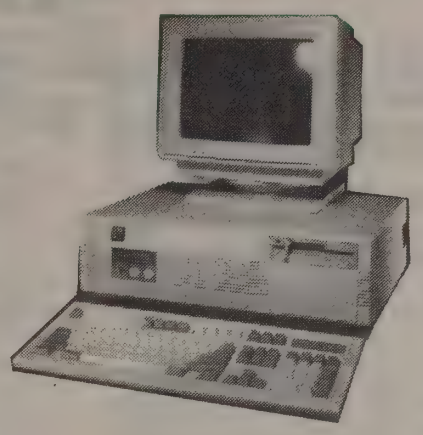

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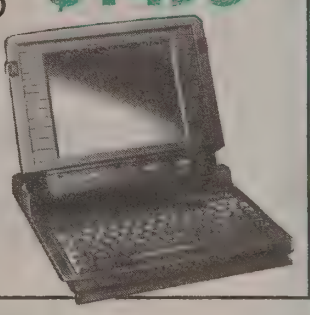

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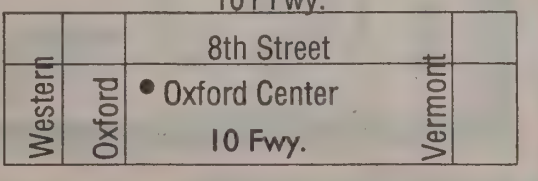

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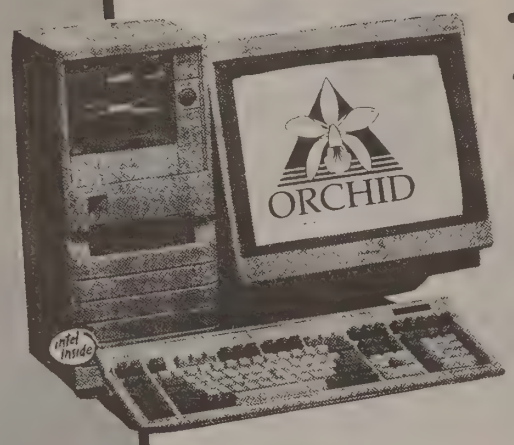

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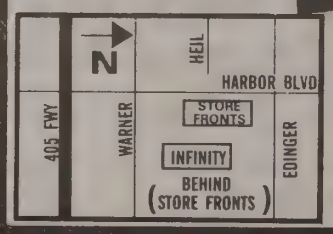

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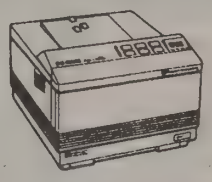

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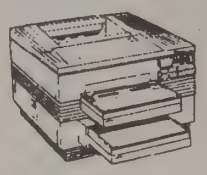

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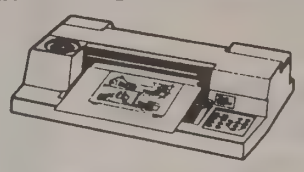

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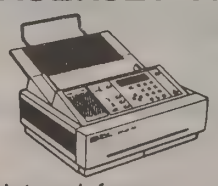

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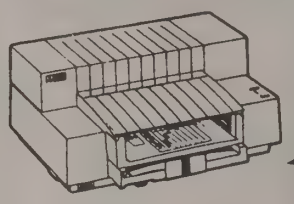

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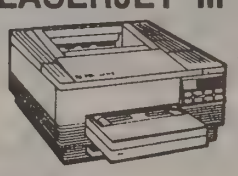

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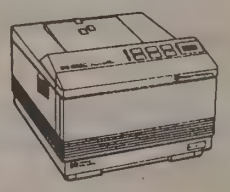

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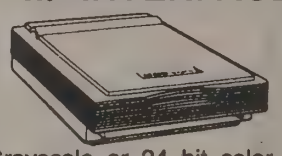

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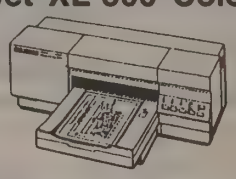

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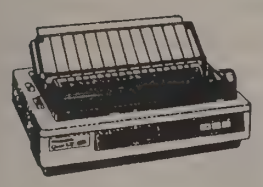

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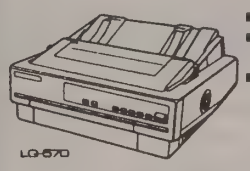

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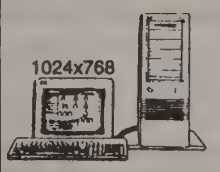

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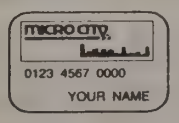

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Commodore Announces Amiga 4000

First Of The Next-Generation Machines Offers New Power

BY DOUGLAS J NAKAKIHARA

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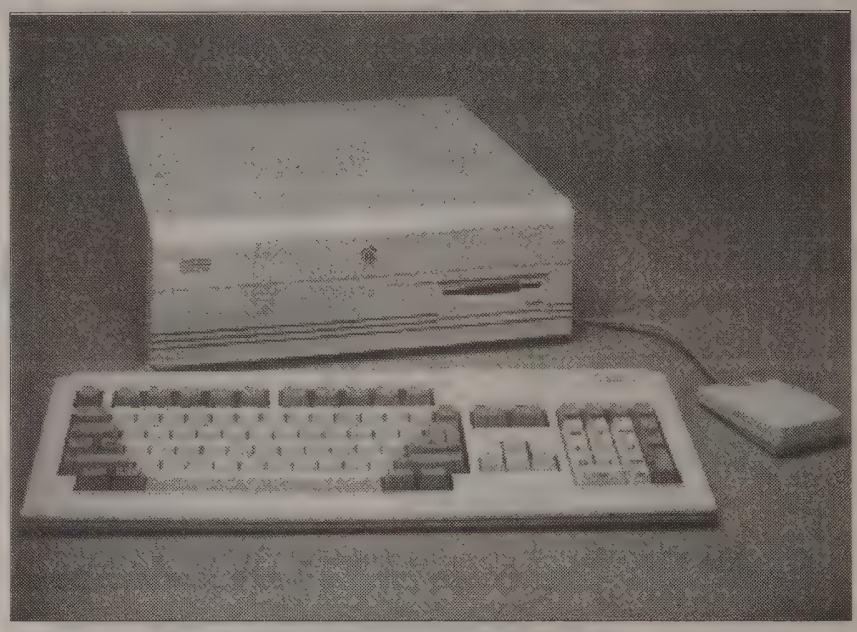

At the recent World of Commodore Amiga show in Pasadena, Commodore unveiled its newest and most powerful Amiga. The Amiga 4000 is the first to use the Advanced Graphic Architecture (or the AA) chip set, and features a new 8-bit HAM mode called HAM8. This allows the use of an incredible 256,000 simultaneous colors from a 24-bit palette (16.7 million colors). The A4000 also sports a new version of the operating system. This is one hot machine!

For the first time, the CPU, a 25MHz 68040, is mounted on a plug-in card installed in a 200-pin processor slot, in order to allow easy upgrades to faster and newer versions of the CPU. Interestingly, the card is the A3640, which also fits in the Amiga 3000T.

FEATURE OVERVIEW

The A4000 has four Amiga Zorro III slots, plus three PC/AT slots. As in the A3000, these slots run horizontally, and the video card slot is in line with one of the Amiga slots. This video slot configuration is exactly like that of the A3000. However, a NewTek representative has indicated that the Video Toaster will not function in the A4000, let alone fit inside.

The A4000 case looks like someone did a "morph" between an A3000 and an A2000, and got stuck in between. It has room for two 3.5" floppy drives and two hard disks. The front bay can hold a 5.25" device, a feature sorely missed on the A3000. Does this indicate the impending arrival of CD-ROM? Jim Dionne, president of Commodore USA, would not confirm this, but did say that Commodore was strongly committed to the CD-ROM technology for the entire Amiga line.

The keyboard, RS-232 serial, parallel, floppy drive, RGB video, and stereo audio jacks are all located on the back of the A4000. The mouse/joystick ports are on the left side. These things get moved with every new Amiga. It's the same old Amiga keyboard but it uses a new mini-connector plug.

The single video jack—there are two on the A3000—outputs horizontal scan rates of 15KHz–31KHz and vertical scan rates of 50Hz–72Hz. The spec sheet indicates that the A4000 requires a VGA or multiscan monitor; however, to utilize all of the display modes, you'll need a multiscan. A standard 1084 monitor will work, but you'll only get the original native display modes.

DCTV did not work with the prototype A4000 I tested, but Digital Creations says that it should work with the final production model; the Digital Creations line of genlocks should work, but a software upgrade might be necessary.

Surprisingly, there is no built-in SCSI controller! Instead, the A4000 supports an IDE disk controller, the MS-DOS current standard, with a generous 120MB hard drive. Obviously, if you need SCSI, you'll need to add a SCSI controller card. Most of the A4000s demonstrated at the show had Commodore's 2091 SCSI controller cards installed, and it was announced that a 32-bit SCSI II card should be available in early 1993.

The A4000 also features an official high-density floppy drive, capable of reading and writing 880K and 1.7MB disks. The drive can also be used on MS-DOS formatted disks using CrossDOS, now built into AmigaDOS. There are currently no plans to make these drives available to other Amiga models.

Like the A3000, the A4000 allows up to 18MB of 32-bit RAM on the motherboard (2MB of chip and 16MB fast). The base configuration comes with 2MB of chip and 4MB of fast RAM. However, unlike the A3000, the A4000 uses industry-standard SIMMs, which should be cheaper and more readily available than the A3000's ZIP chips. The RAM slots are located on the motherboard under the expansion board slots. The power supply has been increased to 150 watts from the A3000's 135 watts.

The Agnus and Denise custom chips have been replaced by Alice and Lisa. The new chips bring with them the new HAM8 mode. Fringing problems, common on standard HAM, are nearly nonexistent with HAM8 due to a larger base color palette. One demonstration showed a HAM8 animation running at 60 frames per second on a standard intuition screen. The demonstrator pulled the window down so we could peek at the Workbench screen—while the animation was running!

The A4000 can even display multiple resolutions at the same time. The AA chip set features the new Super72 modes, including an 800 x 600 resolution. It is worth noting that in current display modes the resolution restricts the number of maximum colors, while with the new model all the color modes are available in all of the resolutions. That means 256,000 colors in resolutions from 320 x 200 all the way up to 1280 x 400. Of course, overscan is available for all resolutions too! Non-HAM screens can display 256 unique colors.

The A4000 also features flicker-free interlaced modes without the need for a deinterlacing device. Everything is handled by the AA chip set. Each display mode is selectable, making all resolutions fully programmable. An additional display bit is even provided for genlocking capabilities.

The Paula chip remains basically un-

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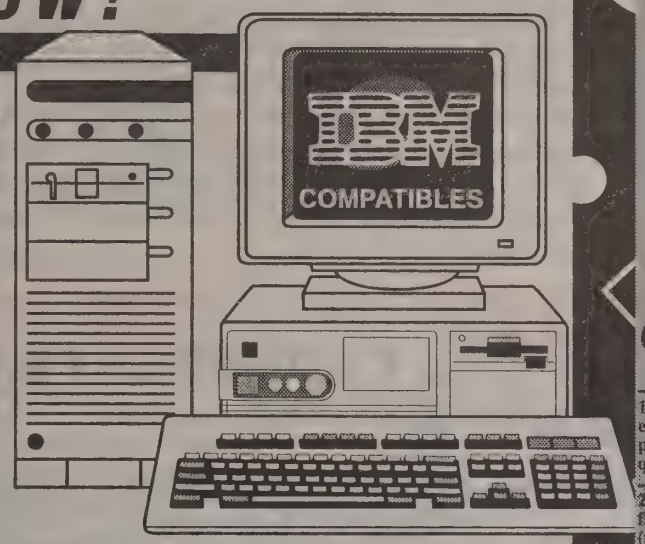

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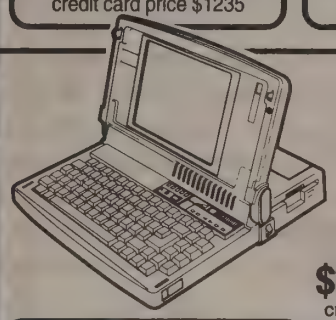

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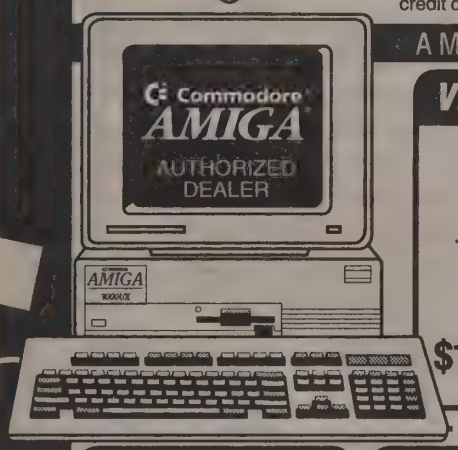

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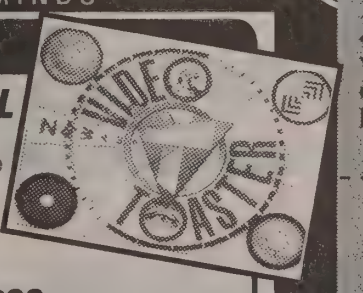

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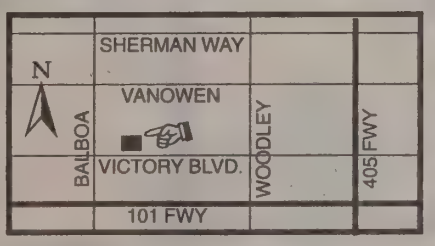

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The Amiga 4000 is the first to use the Advanced Graphic Architecture (or the AA) chip set, and features a new eight-bit HAM mode called HAM8.

changed, so audio is still 8-bit four -channel. It was hinted that Paula will be upgraded at some point in the future, and it appears that most of the custom chips are socketed for possible future upgrades. It should be noted that the A4000 has 32-bit wide access to all custom chips—not just the graphics chip as in the A3000—for a true, full 32-bit system architecture.

The A4000 comes with AmigaDOS 3.0, essentially the same as the upcoming v2.1, but taking advantage of the AA chip set. Programs that behave themselves under AmigaDOS 2.0 should have no compatibility problems with the new version. The new OS contains many new changes including greater customization of Workbench preferences and a PostScript printer driver. Kickstart appeared to be loaded into RAM; however, it's possible that this will change in the production model.

IMPACT

The Amiga market has been flooded with a plethora of third-party, 24-bit color add-ons, all taking their own approach. It remains to be seen what effect HAM8, now a de facto standard, will have on their sales. Of course some higher-end products feature greater resolutions, so those will probably continue to find a market. (If you are thinking 8-bit HAM isn't true 24-bit color, remember that a 640 x 400 screen only contains 256,000 pixels.)

Reaction to the A4000 was extremely positive. It will be interesting to see how, with a list price of only $3699, it affects the sales of A3000s, which list for only $320 less. Currently, the price difference is not an issue, because Commodore is offering a free CDTV with every A3000! One can only hazard a guess that a price adjustment for the A3000 may be near. Even forgetting the A4000's other advantages, you certainly can't buy an '040 accelerator for the '030-based A3000 for 300 bucks!

The only common complaint seems to be about the IDE controller. SCSI is much faster and more powerful since you can daisy-chain up to seven different devices. For various reasons, the IDE does make sense, however. First, most users are non-techies and will never miss the SCSI. Second, this probably shaved a few dollars off the A4000's production cost. Third, if someone wanted to add a second drive, IDE drives are much more readily available, and generally cheaper. Fourth, this gives Commodore some time to perfect its upcoming SCSI II card without holding up the release of the A4000.

This marks the beginning of a new era, since all future Amigas will be based on the AA chip set—in fact, the A4000 is reportedly the low-end model of a new line of Amigas.

What are current Amiga owners going to do? Based on what I've heard, it is unlikely that pre-A4000s could be upgraded to the AA chip set. The technology is just too different. However, Jim Dionne indicated that there will probably be a way for current Amiga owners to trade up to or get a price break on an A4000, as was done with the Amiga 2000 and 3000.

A tower version of the A4000 should be available sometime around March 1993. The new 2.1 operating system should be out in November. For current 2.0 users, this will be a simple floppy-based upgrade. Amigas should start shipping with 2.1 in a few months.

continued on page 128

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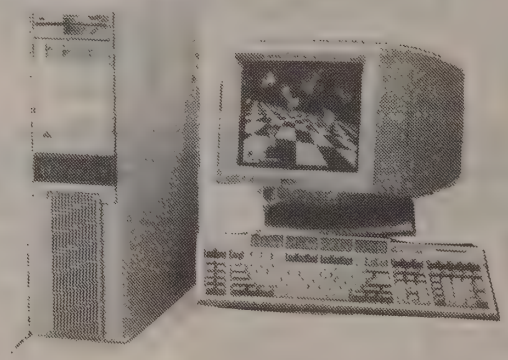

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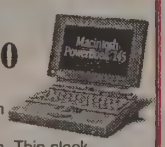

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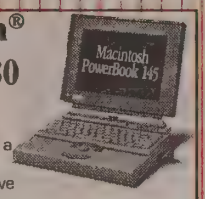

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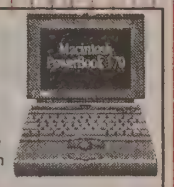

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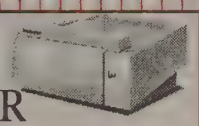

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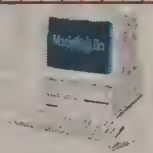

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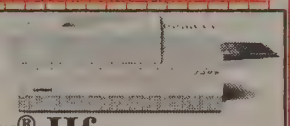

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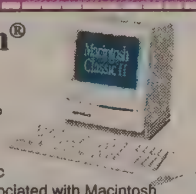

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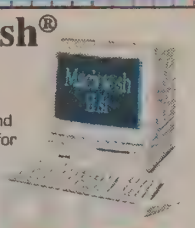

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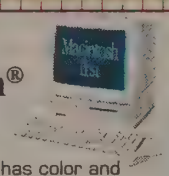

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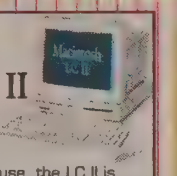

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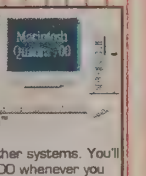

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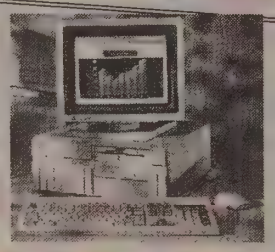

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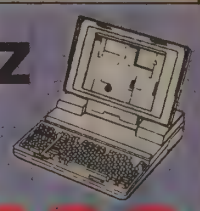

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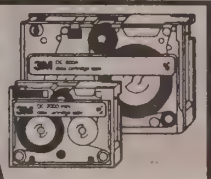

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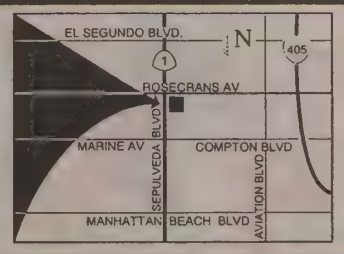

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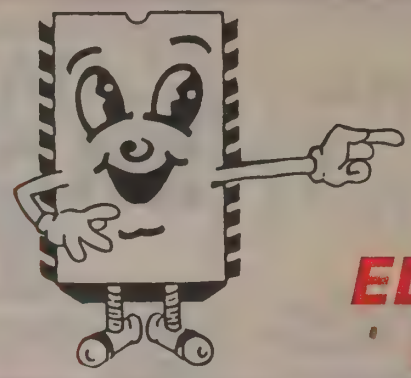

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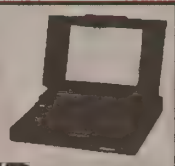

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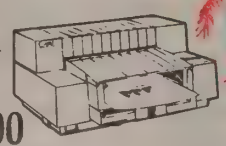

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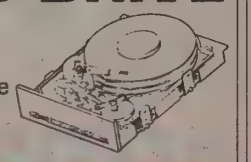

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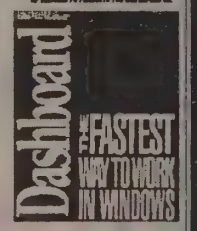

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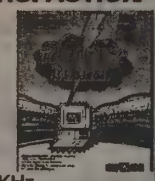

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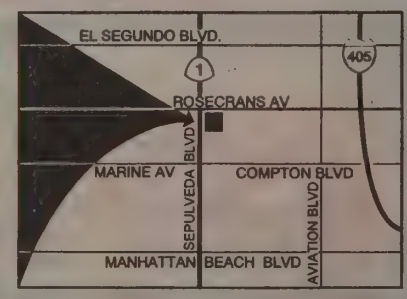

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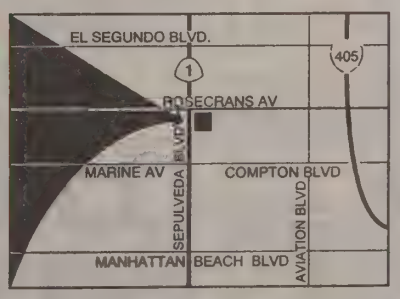

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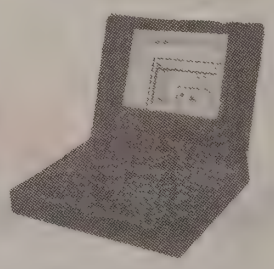

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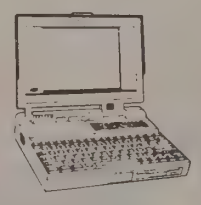

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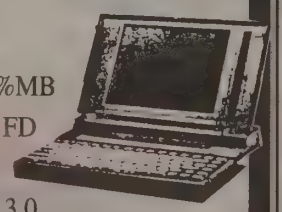

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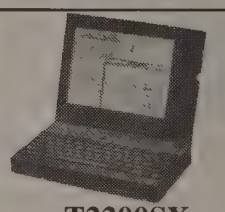

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YOUR FIRST COMPUTER
About Fonts
Or, Why What You Got Wasn't What You Wanted

BY MIKE MARKOWITZ

In the beginning, all words were written by hand, and a proficient scribe was worth more in the slave market than several courtesans. Then they started automating the text business.

First they introduced carved wood blocks, so that one master image could stamp out multiple copies. Then Johann Gutenberg had the bright idea of making movable type out of metal, so one set of blocks could be rearranged to print any possible page. In the nineteenth century they came up with the typewriter, to eliminate all traces of individuality from business correspondence, and inflict the curse of carpal tunnel syndrome on future generations of keyboard drones.

In our own blighted lifetimes we have seen the dawn of the personal computer, and its faithful servant the desktop printer. Now the aspiring scribe can set down winged words in 24-point Garamond Condensed Light rotated 45 degrees, assuming the software is willing to recognize his printer, and assuming the printer is prepared to acknowledge the existence of 24-point Garamond Condensed Light.

When you work with computers, you learn from bitter experience to Never Assume Anything.

Screen displays and printing devices have evolved along separate paths, and the journey text must follow from keyboard to paper is almost as perilous and uncertain as its journey from brain to keyboard. The problem is this: The way computers display words on your screen and the way that printing devices put down text on paper are (usually) radically different.

KINDS OF FONTS

Sans Serif Roman

Monospaced Proportional

Bit-mapped PostScript

6 point

9 point

10 point

12 point

14 point

18 point

24 point

48 point

Because of this mismatch, tons of paper travel every day from the printer output tray directly to the trash bin, because what you got wasn't what you wanted. The cost in time, frustration, and physiological consequences of suppressed rage are hard to estimate.

Consider what happens when you are using a word processor and you press a key—let's say a comma. The computer displays the comma on the screen at the current cursor position. At the same time, the computer attaches the byte (eight digital bits) that represents a comma (00101101) to the end of the current file in memory.

If I'm using a plain old word processor on a plain old PC-compatible, the computer's video card only knows one way to display a comma, so that's what I'll see on the screen. Let's say I want to print the file on the Epson dot matrix printer over in the corner. The printer knows three ways to make a comma—it has three built-in fonts called Draft, Roman and Sans Serif. If I don't push any buttons, I'll get Roman, which is the default. If my word processor has the proper Epson printer driver, and I remember how to put in the right codes or commands, then I can use any of the printer's built-in fonts. The results will not necessarily resemble what I see on the screen.

If I'm using a fancy Windows or Macintosh word processor on a computer connected to a laser printer, things rapidly get more complicated. The printer may have a couple of dozen built-in fonts—it comes from the factory knowing thirty-five different ways to print a comma. Your computer may or may not be able to use all those fonts, depending on how your software was set up when you (or the guy at the computer store) installed it. In addition, you may have any number of "soft" or "downloadable" fonts lurking in your computer. These are files of font information that are transmitted (or "downloaded") to the printer when they are needed.

A DIGRESSION ABOUT BITS

Originally, computers needed only seven digital bits to specify a character. Seven bits gets you 128 possible characters, which is quite sufficient for all the letters of the alphabet, digits, punctuation marks and special control characters. The eighth or "high" bit was left undefined. IBM's Extended Character Set uses the extra bit to add "graphic" characters that let you draw lines and boxes with text. Macintosh fonts use the extra bit to specify all the accented special characters and symbols needed for various foreign languages. It's just another little annoying incompatibility that makes it difficult to share fonts across the chasm that divides the Mac and PC worlds...

WHAT IS A FONT?

When printers and typographers talk about fonts they mean a specific set of characters in a single size and style. Computer people have gotten in the habit of using "font" to describe an entire family of related sizes and styles (which printers often call a typeface). In the non-metric world, type sizes are usually measured in "points," where 72 points equals one inch. Styles are variations on basic letterforms, such as bold, italic, and underlined. Inexperienced users often tend to mix too many fonts and styles recklessly on the same page, creating a document that looks like a ransom note.

KINDS OF FONTS

Consider the Macintosh, which handles the screen as a big picture, made up of various little pictures (a "graphic user interface," as contrasted with the standard text-based PC screen of twenty-five lines, each line having eighty characters). Originally, there was only one kind of Macintosh font, which consisted of "bit-mapped" characters in various sizes. The screen displayed the characters at 72 dots per inch, and Apple's dot-matrix ImageWriter printed them out at 72 dots per inch. This is the ideal font architecture—the screen display and the printing device share the same "imaging model."

Mac fonts had cute city names (Chicago, Monaco, Geneva, New York) and every Mac had the same basic set, so if you sent a document on disk to your friends, they could see it exactly the way you wrote it. The major drawback of bitmapped fonts is that they require a separate set of little pictures for every size and style.

This rapidly eats up disk space. For really big letters or in-between sizes, the computer had to use simple geometrical scaling, which often produced jagged, misshapen letters of startling ugliness.

Around 1986, high-resolution laser printers became affordable for affluent computer users, and the font business started getting com-

continued on page 124

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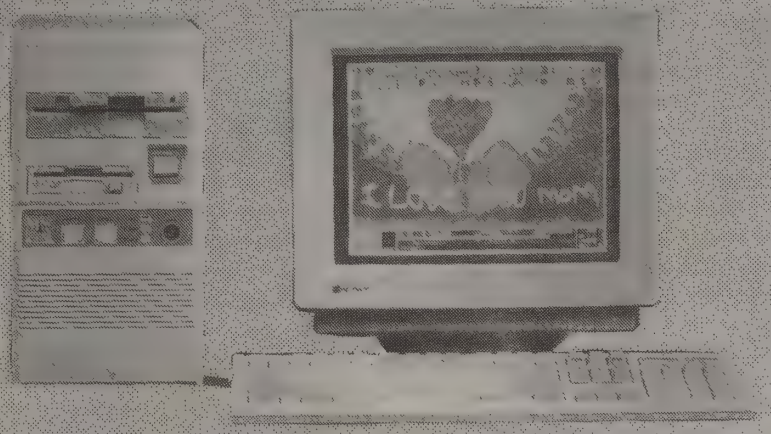
386SX-33 $858



386DX-33MHz

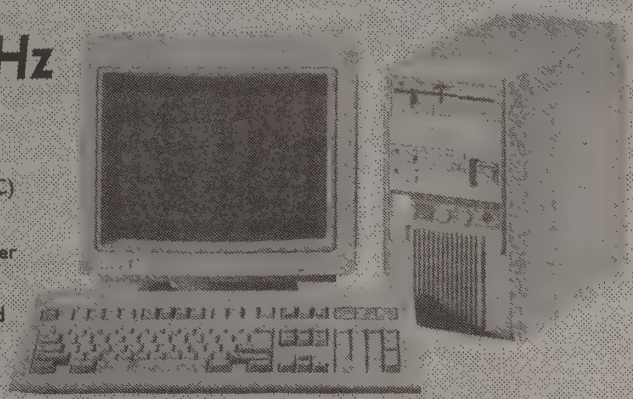
- 33MHz Intel CPU
- 64KB Cache
- 4 MB SIMM RAM (70ns) (32 MB Upgradeable)
- 1.2 MB & 1.44 MB Floppy Drive (TEAC)
- 80 MB IDE Drive
- IDE I/O 2S, 1P, 1G Ports
- 14" 1024 x 768 (0.28 Dot) Super VGA Monitor
- 16 Bit Super VGA Card with 512KB Memory on Board
- Digital Mini Tower Case with 200 Watt Power Supply
- 101 Enhanced Keyboard
- Hi-Res MS Compatible Mouse

$1138

386DX-40MHz

- 40MHz CPU (AMD)
- 64KB CACHE 4 MB RAM (70ns) (64 MB Upgradeable)
- 1.2 MB & 1.44 MB Drive (TEAC)
- 120 MB IDE Drive
- IDE I/O 2S, 1P, 1G Ports
- 14" 1024 x 768 (0.28 Dot) Super VGA Monitor
- 16 Bit Super VGA Card with 512KB Memory on Board
- Digital Mini Tower Case with 200 Watt Power Supply
- 101 Enhanced Keyboard
- Hi-Res MS Compatible Mouse

$1158



486-33 ISA

- 33MHz Intel CPU
- 64KB Cache
- 4 MB RAM (70ns) (64 MB Upgradeable)
- 1.2 MB & 1.44 MB Floppy Drive (TEAC)
- 100 MB Hard Drive
- IDE I/O 2S, 1P, 1G Ports
- 14" 1024 x 768 (0.28 Dot) Super VGA Monitor
- 16 Bit Super VGA Card with 1 MB Memory on Board
- Digital Mini Tower Case with 200 Watt Power Supply
- 101 Enhanced Keyboard
- Hi-Res MS Compatible Mouse

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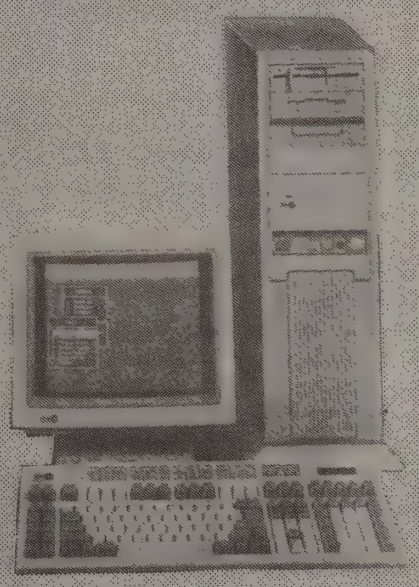
486-50 ISA

- 50MHz Intel CPU
- 256 KB Cache
- 4 MB SIMM RAM Memory (70ns) (64 MB Upgradeable)
- 1.2 MB & 1.44 MB Floppy Drive (TEAC)
- 200 MB Hard Drive (12ms)
- IDE I/O 2S, 1P, 1G Ports
- 14" 1024 x 768 (0.28 Dot) Super VGA Monitor
- 16 Bit Super VGA Card with 1 MB Memory on Board
- Digital Middle Tower Case with 230 Watt Power Supply
- 101 Enhanced Keyboard
- Hi-Res MS Compatible Mouse

$1898



386DX-33MHz Notebook

- 33MHz Intel CPU
- 32KB Cache
- 32 Grayscale
- 4 MB RAM on Board (16 MB Expandable)
- 120 MB IDE Hard Drive
- 3.5" & 1.44 MB Floppy Drive
- VGA Port for Color Monitor
- Supertwist LCD with CCFT Backlit
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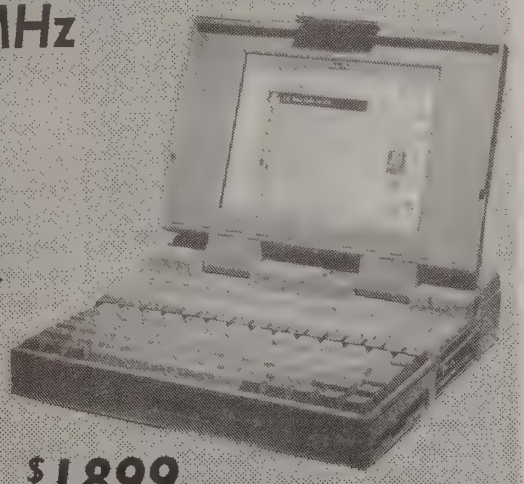
- 2 Serial, 1 Parallel Ports
- Removeable NICAD Battery w/ Charger
- Enhanced Multifunctional Keyboard
- 11" W x 8.6" D x 2" H



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DC 486DX-50MHz & 486DX-33MHz 256K Cache with LOCAL BUS System

DC 486DX-33MHz 256K Cache SYSTEM

* Intel 80486DX-33MHz Processor
* 256K Cache Memory
* 4MB RAM installed Exp. to 32MB
* Middle Tower case with 230 watt power supply
* 1.2MB & 1.4MB TEAC Floppy Drives
* 130MB Hard Drive 15ms
* 1:1 Dual FD/HD Controller card
* 2 Serial, 1 Parallel, 1 Game Port
* Trident Super VGA card w/1MB
* 1024x768 NON-INTERLACED SVGA color Monitor .28 dot pitch
* 101 Enhanced Keyboard
* Hi-Resolution Mouse

$1465

DC 486DX-50MHz 256K Cache SYSTEM

* Intel 80486DX-50MHz Processor
* 256K Cache Memory
* 4MB RAM installed Exp. to 32MB
* Middle Tower case with 230 watt power supply
* 1.2MB & 1.4MB TEAC Floppy Drives
* 213MB Hard Drive 12.4ms
* 1:1 Dual FD/HD Controller card
* 2 Serial, 1 Parallel, 1 Game Port
* Trident Super VGA card w/1MB
* 1024x768 NON-INTERLACED SVGA color Monitor .28 dot pitch
* 101 Enhanced Keyboard
* Hi-Resolution Mouse

$1845

DC 486-50MHz DX/2 SYSTEM

* Intel 486-50MHz DX/2 Processor
* 256K Cache Memory
* 4MB RAM installed Exp. to 32MB
* Middle Tower case with 230 watt power supply
* 1.2MB & 1.4MB TEAC Floppy Drives
* 130MB Hard Drive 15ms
* 1:1 Dual FD/HD Controller card
* 2 Serial, 1 Parallel, 1 Game Port
* Trident Super VGA card w/1MB
* 1024x768 NON-INTERLACED SVGA color Monitor .28 dot pitch
* 101 Enhanced Keyboard
* Hi-Resolution Mouse

$1565

DC 486SX-25MHz w/64K Cache

* Intel 80486SX-25MHz Processor
* 64K Cache Memory
* 4MB RAM installed Exp. to 32MB
* Mini-Tower case with 230 watt power supply
* 1.2MB & 1.4MB TEAC Floppy Drives
* 130MB MAXTOR Hard Drive 15ms
* 1:1 Dual FD/HD Controller card
* 2 Serial, 1 Parallel, 1 Game Port
* Trident Super VGA card w/1MB
* 1024x768 NON-INTERLACED SVGA color Monitor .28 dot pitch
* 101 Enhanced Keyboard
* Hi-Resolution Mouse

$1195

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Tseng Labs ET4000 32-bit Local Bus Super VGA card w/1MB. Displays 32,768 colors. Resolution up to 1280 x 1024. 72Hz refresh rate.

Add **$85**

S3 (IBM XGA) graphics accelerator 32-bit Local Bus Super VGA card w/1MB VRAM. Displays 32,768 colors. Resolution up to 1280 x 1024. 72Hz Refresh rate.

Add **$175**

IDE Cache Controller card w/1MB, max 16MB, 0.4ms access time, 5 MB/s transfer rate, supports 2 IDE HDDs & 2 FDDs

Add **$195**

72Hz REFRESH RATE NON-INTERLACED, LOW RADIATION MONITOR UPGRADE. 1280x1024. 14-inch SUPER VGA COLOR MONITOR .28 DOT PITCH.

Add **$65**

17 inch Super VGA NON-INTERLACED color monitor upgrade. VESA 72Hz Refresh rate at all resolution. .28 dot pitch.

Add **$525**

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* AMD 80386-40MHz Processor
* 64K Cache Memory
* 4MB RAM installed Exp. to 32MB
* Mini-Tower Case w/230 watt P/S
* 1.2MB & 1.4MB TEAC Floppy Drives
* 130MB Hard Drive 15ms
* 1:1 Dual FD/HD Controller
* 2 Serial, 1 Parallel, 1 Game Port
* Trident Super VGA card w/1MB
* 1024 x 768 Super VGA color Monitor .28 dot pitch
* 101 Enhanced Keyboard
* Hi-Resolution Mouse

$1075

DC 386DX-25MHz

* 80386DX-25MHz Processor
* 4MB RAM installed Exp. to 32MB
* Mini-Tower Case w/230 watt P/S
* 1.2MB & 1.4MB TEAC Floppy Drives
* 85MB Hard Drive
* 1:1 Dual FD/HD Controller
* 2 Serial, 1 Parallel, 1 Game Port
* Super VGA card w/512K
* 1024 x 768 Super VGA color Monitor .28 dot pitch
* 101 Enhanced Keyboard
* Hi-Resolution Mouse

$945

DC 386SX-33MHz 2MB System

* AMD 80386SX-33MHz Processor
* 2MB RAM installed Exp. to 16MB
* Mini-Tower Case w/230 watt P/S
* 1.2MB OR 1.4MB TEAC Floppy Drive
* 40MB Hard Drive
* 1:1 Dual FD/HD Controller
* 2 Serial, 1 Parallel, 1 Game Port
* Super VGA card w/256K
* 1024x768 SVGA color Monitor .39mm
* 101 Enhanced Keyboard

$725

DC 386DX-40MHz w/64K Cache

* 80386DX-40MHz Processor
* 64K Cache Memory
* 4MB RAM installed Exp. to 32MB
* Mini-Tower Case w/230 watt P/S
* 1.2MB & 1.4MB TEAC Floppy Drives
* 85MB Hard Drive
* 1:1 Dual FD/HD Controller
* 2 Serial, 1 Parallel, 1 Game Port
* Super VGA card w/512K
* 1024 x 768 Super VGA color Monitor .28 dot pitch
* 101 Enhanced Keyboard
* Hi-Resolution Mouse

$985

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Soundblaster Pro Multimedia package	$560
PANASONIC 1123 24-pin printer	$196
PANASONIC 2124 24-pin color printer	$325

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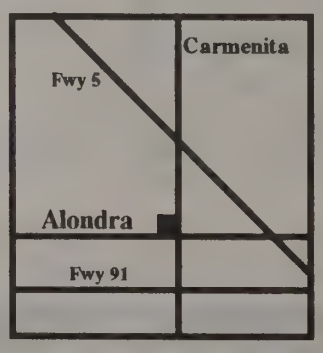

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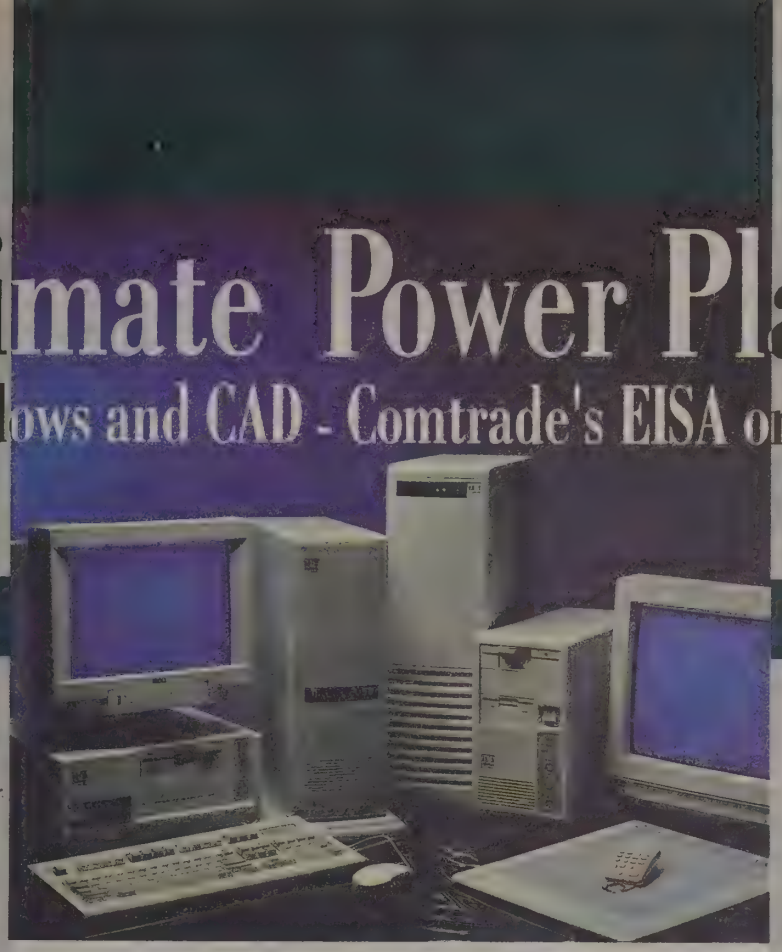

486 EISA WinStation

- 64K Super Fast Write-Back Cache SRAM
- 4 MB RAM & Built-in 487 Math Coprocessor
- 1.2 MB & 1.44 MB Floppy Drives
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- Diamond Stealth S3 VRAM Graphics Accelerator (Up to 25X faster than regular SVGA)
- 14" Non-interlaced .28mm SVGA Monitor
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486/33 DX $2125
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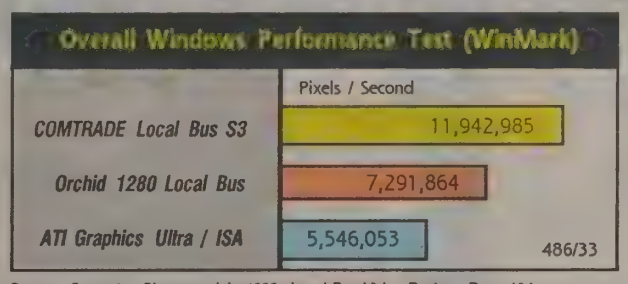

Source: Computer Shopper, July 1992. Local Bus Video Review. Page 184.

486 EISA Advantage

- 64K Super Fast Write-Back Cache SRAM
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- 1.2 MB & 1.44 MB Floppy Drives
- 130 MB 15ms IDE 64K Cache Drive
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- 16-Bit 1024x768 SVGA Card with 1MB RAM
- 14" Non-interlaced .28mm SVGA Monitor (VESA Standard for 72Hz Flicker-Free)
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- Free MS-DOS 5.0 & Windows 3.1

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486/50 DX2 $2015
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486/66 DX2 $2445

- 8MB RAM & 210MB Drive Add $320
- 510MB Hard Drive & EISA Controller Add $960

Local Bus SVGA

- 64K Super Fast Write-Back Cache SRAM
- 4 MB RAM & Built-in 487 Math Coprocessor
- 1.2 MB & 1.44 MB Floppy Drives
- 130 MB 15ms IDE 64K Cache Drive
- 32-Bit Turbo ET-4000 Super VGA with 1MB RAM (Upto 1280x1024 & 32K Colors) (5X faster than regular SVGA)
- 14" Non-interlaced .28mm SVGA Monitor (VESA Standard for 72Hz Flicker-Free)
- 2 Serial, 1 Parallel & 1 Game Ports
- Enhanced 101-key Keyboard
- Hi-Resolution 400DPI Serial Mouse
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* 4MB RAM UP TO 32MB RAM ON BOARD
* 1.2MB & 1.44MB FLOPPY DRIVE
* **212MB HD, 15MS (BUILT-IN 64K CACHE)**
* EISA DUAL IDE FD/HD CONTROLLER
* AT I/O: 2 SERIAL/1 PARALLEL/1 GAME
* 101 ENHANCED KEYBOARD
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* **17" 1280 x 1024 SVGA MONITOR, FLAT SCREEN**

SALE PRICE: $3395 *CASH DISCOUNT:* **$3295**

486DX-50MHz

* INTEL 40486 PROCESSOR WITH BUILT-IN MATH
* **256K CACHE RAM**
* 4MB RAM UP TO 32MB RAM ON BOARD
* 1.2MB & 1.44MB FLOPPY DRIVE
* **212MB HD, 15MS (BUILT-IN 64K CACHE)**
* DUAL IDE FD/HD CONTROLLER
* AT I/O: 2 SERIAL/1 PARALLEL/1 GAME
* 16 BIT SUPER VGA CARD W/1MB RAM
* 14" 1024 x 768 0.28 DOT SVGA MONITOR
* 101 ENHANCED KEYBOARD

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486DX2-50 LOCAL BUS
W/32 BIT SVGA 1MB, 1280 x 1024

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CASH DISCOUNT: **$2050**

486DX-33MHz

* INTEL 40486 PROCESSOR WITH BUILT-IN MATH
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* 1.2MB & 1.44MB FLOPPY DRIVE
* 125MB HD, 17MS (BUILT-IN 32K CACHE)
* DUAL IDE FD/HD CONTROLLER
* AT I/O: 2 SERIAL/1 PARALLEL/1 GAME
* 16 BIT SUPER VGA CARD W/1MB RAM
* 14" 1024 x 768 0.28 DOT SVGA MONITOR
* 101 ENHANCED KEYBOARD

SALE PRICE: $1495

CASH DISCOUNT: **$1450**

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W/32 BIT SVGA 1MB, 1280 x 1024

SALE PRICE: $1645

CASH DISCOUNT: **$1595**

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* 4MB RAM UP TO 32MB RAM ON BOARD
* 1.2MB & 1.44MB FLOPPY DRIVE
* 125MB HD, 17MS (BUILT-IN 32K CACHE)
* DUAL IDE FD/HD CONTROLLER
* AT I/O: 2 SERIAL/1 PARALLEL/1 GAME
* 16 BIT SUPER VGA CARD W/1MB RAM
* 14" 1024 x 768 0.28 DOT SVGA MONITOR
* 101 ENHANCED KEYBOARD

SALE PRICE: $1230

CASH DISCOUNT: **$1195**

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* 64K CACHE RAM
* 4MB RAM UP TO 32MB RAM ON BOARD
* 1.2MB & 1.44MB FLOPPY DRIVE
* 105MB HD, 17MS (BUILT-IN 32K CACHE)
* DUAL IDE FD/HD CONTROLLER
* AT I/O: 2 SERIAL/1 PARALLEL/1 GAME
* 16 BIT SUPER VGA CARD W/1MB RAM
* 14" 1024 x 768 0.28 DOT SVGA MONITOR
* 101 ENHANCED KEYBOARD

SALE PRICE: $1128

CASH DISCOUNT: **$1095**

EISA BUS

32 BIT EISA FD/HD CONTROLLER

* INTEL 40486 PROCESSOR WITH BUILT-IN MATH
* **256K CACHE RAM**
* 4MB RAM UP TO 32MB RAM ON BOARD
* 1.2MB & 1.44MB FLOPPY DRIVE
* AT I/O: 2 SERIAL/1 PARALLEL/1 GAME
* 16 BIT SUPER VGA CARD W/1MB RAM
* 14" 1024 x 768 0.28 DOT SVGA MONITOR
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CASH DISCOUNT: **$2550**

486DX-33MHz 125MB HD (17MS)

SALE PRICE: $2175

CASH DISCOUNT: **$2095**

386SX-25MHz

* 1MB RAM UP TO 32MB RAM ON BOARD
* 1.2MB & 1.44MB FLOPPY DRIVE
* 40MB HD, 24MS (BUILT-IN 32K CACHE)
* DUAL IDE FD/HD CONTROLLER
* AT I/O: 2 SERIAL/1 PARALLEL/1 GAME
* 16 BIT SUPER VGA CARD W/512K RAM
* 14" 1024 x 768 0.28 DOT SVGA MONITOR
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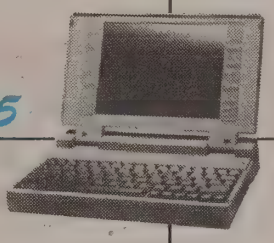

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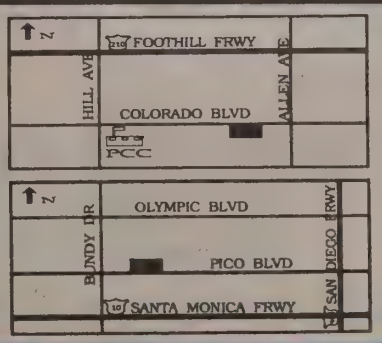

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(all boards include CPU, BIOS & manuals)

286-16 (AMI BIOS)	$62.00
286-20 (AMI BIOS)	$69.00
386SX-16 (AMI BIOS)	$99.00
386SX-25 (AMI BIOS)	$109.00
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- 1024x768 Super VGA Monitor
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- 101 Enhanced Keyboard
- Hi-Res Serial Mouse

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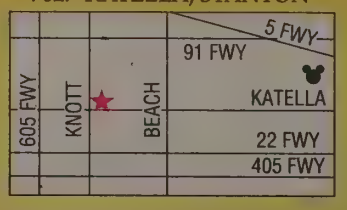


PRODUCT SPOTLIGHT

Product Reviews

REVIEWS

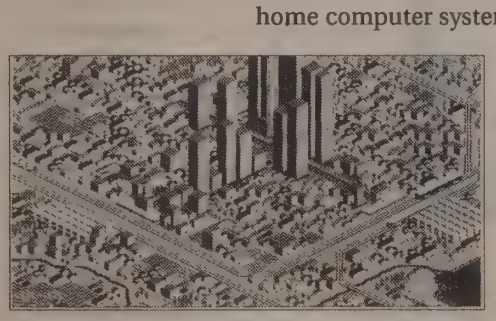
GAMES

By Mike Markowitz

A-TRAIN

Designed By: Artdink (T. Nagahama, H. Kanda, S. Sako, et al.)
Published By: Maxis
For: MS-DOS (12MHz or faster; 640K, VGA or EGA graphics, mouse recommended, supports most audio cards) Macintosh and Amiga versions scheduled for release later in 1992
List Price: $69.95

A-Train was orginally developed in Japan, where three successive versions were big hits on several different home computer systems. Maxis bought the rights from Artdink to do an Americanized version. This "software toy" operates on three levels. First, you design and manage a railroad. Second, you develop a city around your rail system. Third, you have to build a financial empire by dealing in real estate and stocks. Much more than a choo-choo simulator, A-Train is sort of like SimCity for capitalists.



Your empire consists of a vast plain with scattered settlements and an existing rail line that connects to the outside world. You can choose any of six different regions, each presenting a different set of problems. The main display shows a small section of your world, using an isometric projection to create a three-dimensional illusion of depth and perspective. You can also bring up a "satellite view" window that shows a map of the entire region. The simulation cycles through day and night and through the seasons of the year—you can speed up or slow down the clock rate.

Graphics And Animation: 9
Sound: 7
User Interface: 7
Overall Play Value: 8

Menu options allow you to lay tracks, buy and schedule trains, buy or sell land and develop commercial and residential properties. Trains may be passenger or freight, there are nineteen different types from which to choose. The program provides an extensive array of financial reports and balance sheets to let you know how you are doing, but there is no way to print out this data for off-line reference (unless you use a screen capture utility).

Continued

PRODUCT UPDATES

➤**DacEasy** released **DacEasy Accounting, Payroll, and Point of Sale v4.3**. DacEasy, Inc., 1790 Preston Rd., Suite 800, Dallas, TX 75252. 1-800-DAC-EASY.

➤**Deneba Software** announced the **upgrade** to **Big Thesaurus 2**. System 7 savvy, Big Thesaurus is a System Extension offering a complete, online electronic thesaurus for the Macintosh. Deneba Software, Inc., 7400 S.W. 87th Ave., Miami, FL 33173. (305)596-5644.

➤**Fifth Generation** released **Fastback Plus Mac 3.0**, the first major revision to its backup program since v2.6 was introduced ten months ago. Registered users of any previous version can upgrade for $30. Fifth Generation Systems, Inc., 10049 N. Reiger Rd., Baton Rouge, LA 70809. (504)291-7221.

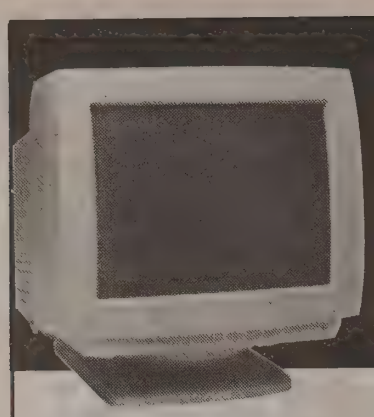
➤**OWL International** released **GUIDE Professional Publisher v2.0** a hypertext-based publishing system that converts existing print and online documents for electronic distribution and display. OWL International, Inc., 2800 156th Ave. S.E., Bellevue, WA 98007. (206)747-3203.

➤**P.I.M., Inc.**, released **Info-Mation 1.1**, its personal information management software for the Macintosh. Personal Info-Mation Management, Inc., 555 Pierce St., Suite 5, Albany, CA 94706. 1-800-444-4PIM.

➤**Software Publishing** announced **Harvard Draw for Windows 1.01** that incorporates Adobe Type Manager, support for TrueType and Type 1 fonts, and includes thirteen new Adobe Type 1 fonts. Current uses can obtain the v1.01 update kit for a $15 shipping and handling fee. Software Publishing Corp., 3165 Kifer Rd., PO Box 95483, Santa Clara, CA 95056-0983. (408)988-7818.

➤**Strategic Mapping** introduced **Atlas Pro 1.5**, a major upgrade to its geographic information management system for the Macintosh. The new version adds more extensive connectivity to databases, improved street-level mapping and address matching, and new tools for zooming the map. Free upgrade for registered users. Users of Atlas MapMaker can trade up to Atlas Pro for $249 until December 31, 1992. Strategic Mapping, Inc., 3135 Kifer Rd., Santa Clara, CA 95051. (408)970-9600.

➤**Traveling Software** introduced **LapLink Pro Release 4**, the newest version of its file transfer utility. The upgrade will be available for the first time through the retail outlets. Traveling Software, Inc., 18702 N. Creek Pkwy., Bothell, WA 98011. (206)483-8088.



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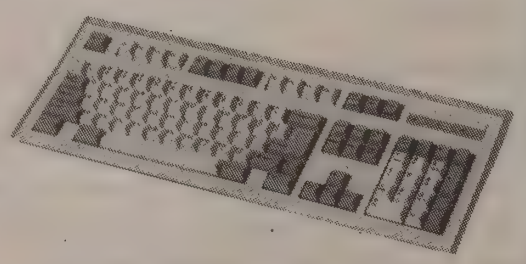

VGA CARDS

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PRODUCT SPOTLIGHT

A-Train is a very deep and complex simulation, but you are not completely helpless. From time to time, "advisors" will pop up on the screen to offer suggestions or correct your mistakes.

The train types are Japanese, as are some nice little details, like the red-crowned cranes you can see when they fly south in October and north in April.

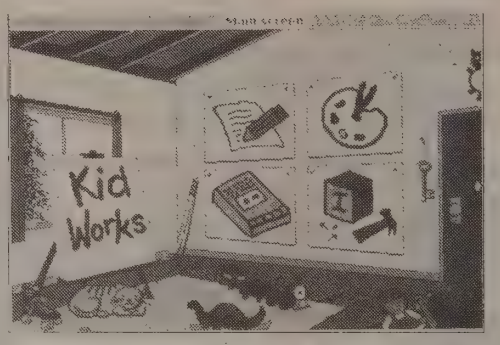
The illustrated 140-page manual includes an elaborate Tutorial to teach you the basics, a complete Reference section, and a nice little history of railroading. There are also bits of railroad slang, songs, and stories.

A-Train is too complex for casual entertainment, but it should appeal to fans of SimCity as well as railroad buffs.

KIDWORKS 2

Designed By: Cathy Siegel and Dori Friedman
Published By: Davidson
For: Macintosh (SE or later CPU, color or monochrome, 2MB for System 6.07, 4MB for System 7)
List Price: $59.95

One of the most important things in the design of educational software is creating a sense of wonder for the user. KidWorks 2 meets this requirement with a very smooth implementation of text-to-speech processing. There is still something magical about hearing a computer speak the words you write. This is an old trick on the Macintosh—the Macintalk text-to-speech application was introduced in 1984 with the original 128K Mac.



KidWorks 2 is aimed at ages four to ten, but includes painting and writing tools that could easily appeal to older users. The opening screen is a room filled with animated toys (a shameless clone of the concept in Brøderbund's *Playroom* and *Treehouse*). An easel holds pictures that represent the program's four modules or activities: Story Writer, IconMaker, Story Illustrator, and Story Player.

The Story Writer is a text editing screen with about five lines of large text (the default font is 36-point KidText, based on traditional classroom standard letterforms, but you can choose any other 18- or 36-point font on your system). About 250 common nouns, verbs and adjectives can be represented by icons—you can toggle the display between plain text and text mixed with the picture icons. Click on the speech button and the program will take a shot at voice output of whatever you have written. The IconMaker lets you add your own word pictures to the program's vocabulary, you can even specify how they should be pronounced, since the speech synthesizer may guess wrong on the phonetics of an ambiguous spelling.

Story Illustrator is a paint program with a standard set of tools plus a few special effects and a set of "stamps" (small graphic objects like trees, arrows and animals). There are eleven ready-made background pictures (forest, city, castle, beach, desert, etc.). Depending on your color video mode, the Story Illustrator provides either sixteen or sixty-four colors. Any picture can be

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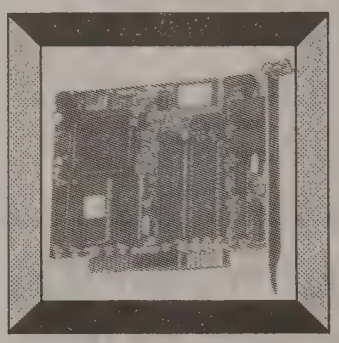

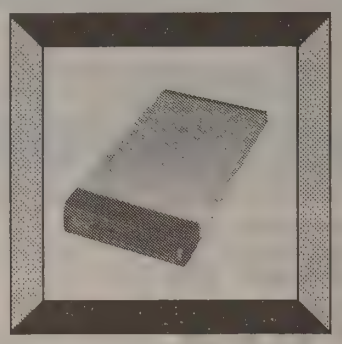

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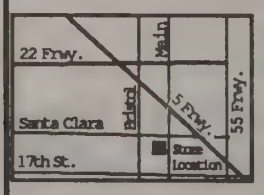

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saved to the Picture Box, and inserted into a story in the Story Writer (where it appears as a thumbnail view). In the Story Player your pictures appear in full size, with two lines of text underneath. The Story Player uses the metaphor of an audio tape player, you can start, stop, pause, rewind or fast-forward through the sequence of text and pictures

Graphics and Animation: 8
Sound: 8
User Interface: 9
Overall Value: 8

A lot of thought went into the KidWorks 2 user interface. Standard Macintosh dialog boxes have been replaced with graphic icons, and a Talking Help feature lets you hear the explanations as you read them. The program can import PICT files. A Child Safety Mode prevents the littlest users from accidentally quitting the program or getting lost in the Finder. A Sign-In option creates individual personal folders for each child who uses the program. The program supports color output on color-capable printers.

KidWorks 2 requires at least 2MB of free hard disk space. The program is easily installed from three 800 K floppy disks. I had no trouble running the program on a Mac PowerBook 100. There is an illustrated 44-page user manual.

VIDEO POKER FOR WINDOWS

Designed By: Roger Gilbertson and James Michael
Published By: Masque Publishing
For: Windows 3.0 or later; supports Multimedia PC audio standard
List Price: $54.95

Video Poker has become one of the most popular games in the casinos of Las Vegas and Atlantic City. Unlike slot machines or pure games of chance, it involves a considerable element of skill. You gotta know when to hold 'em, know when to fold 'em, etc.

The game is quite simple. You place an initial bet of one to five coins, and then five cards are dealt. You may discard any of these, and then draw to obtain your final hand. The machine evaluates this hand to determine the payout, if any. Different payout tables are used in different versions of the game, so the first element of strategy is knowing which machines to play.

Video Poker for Windows is, in effect, a poker machine simulator and trainer, enabling the would-be high-roller to practice, practice, practice, without risking real money. The aim is to develop an intuitive feel for the average payout or "expected value" of any hand. Leonard Frome, who developed the strategies used in the program, is billed as a math instructor at the University of Nevada and consultant to manufacturers of gaming equipment.

Graphics and Animation: 6
Sound: 7
User Interface: 8
Overall Play Value: 6

The package includes both 5.25" and 3.5" disk formats, and is easily installed from Windows' **Run...** dialog box. The program takes up about 500K of disk space after installation. The Windows implementation is very well done; the program uses scalable fonts; you can shrink the game window to a quarter of the screen, launch four instances of the program, and play four games at once, if your system has enough RAM.

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The very good Online Help follows the standard Windows format. The 91-page pocket-sized manual includes the following disclaimer:

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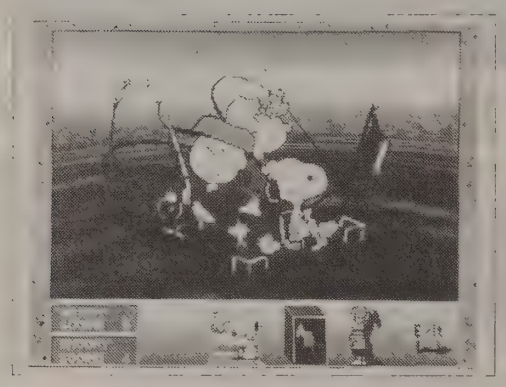

SNOOPY'S GAME CLUB

Designed By: Gónene Smith and Mike Berlyn
Published By: Accolade
For: MS-DOS (640K, MCGA, EGA or VGA graphics, 10+ MHz processor and mouse recommended, popular audio cards supported)
List Price: $49.95

The Peanuts characters created by cartoonist Charles Schulz over thirty years ago have contributed their wholesome and gentle irony to the marketing of every imaginable product and service. Poor Charlie Brown, Lucy, Linus, Snoopy, and Woodstock even try to sell us life insurance. So it should be no surprise that Accolade (the entertainment software powerhouse) has inked a multi-year licensing deal with United Features Syndicate (the corporate giant that controls your favorite imaginary characters), for a line of kid-oriented Peanuts software.

Graphics and Animation: 8
Sound: 8
User Interface: 6
Overall Value: 8

Despite the rumbling of Serious Money in the background, the first package in the series, Snoopy's Game Club, is an engaging and well-designed set of three very different games for ages 3–8 and beyond.

Charlie Brown's Picture Pairs is similar to the old TV game show *Concentration*. You choose a pair of hidden tiles to flip over. If the tiles match, they both go bouncing off the screen; if they don't match, they are hidden again, and you try to remember what went where. You can play with eight, eighteen, or thirty-six tiles, using either letters of the alphabet or pictures of the Peanuts characters.

Snoopy's Animated Puzzles is a remarkable little programming achievement. There are nine different animated scenes that can be scrambled into as many as sixty-four pieces. You have to put the puzzle back together by pointing and clicking while each piece continues to move. It's quite a challenge, and great fun.

Woodstock's Look-Alikes is similar to the pattern-recognition puzzles used in some intelligence tests. You are presented with up to eighteen cartoon characters, fish or tree leaves and you have to select

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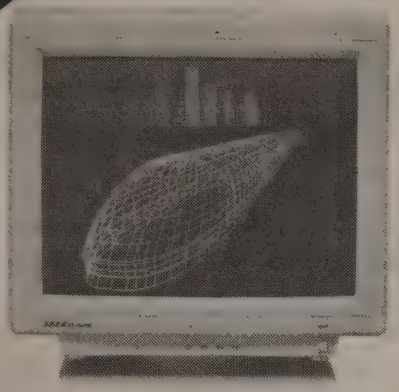

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MF-5321A (A/R Panel)	30 to 80kHz	.31	1280 x 1280
MF-5421A (A/R Panel)	30 to 80kHz	.26	1600 x 1280

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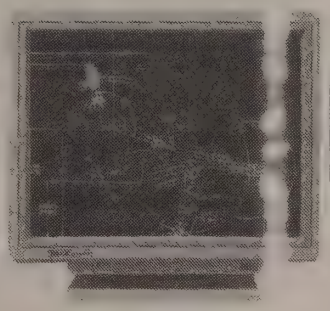

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PC SOFTWARE REVIEW

QUICKSCORE DELUXE

Published By: Dr. T's Music Software
List Price: $149
Reviewed By: George M. Skarpelos

All musicians with a smidgen of interest in computers have, at one time or another, pondered the incredible possibilities posed by the marriage of these machines with music. The arduous task of scoring a piece of music becomes as simple as typing into a word processing program. MIDI (Musical Instrument Digital Interface) lets you transcribe a keyboard part even if you do not read music; the software does all the transcribing for the user.

QuickScore Deluxe is a low-priced entry into the fast expanding PC music software market. It provides both scoring and sequencing functions in one program. QuickScore supports up to sixteen different tracks or staffs that can drive either internal FM synthesizers or outboard music workstations. The user can view entire scores by page or by track. QuickScore needs at least 540K of conventional DOS memory to run and a compatible sound card. Though it will run on an XT, the slow CPU speed can cause timing problems with auto-scrolling. Dr. T's Music Software recommends a 386 machine for trouble-free operation.

Generally, I found QuickScore lacking in several areas. In terms of notating and editing with the mouse, the interface was clumsy, barely intuitive, and inconsistent. Note ties would be created inadvertently and there was no drag and drop editing. It was impossible to insert a rest. While visually scrolling through the score during playback, the notes are not highlighted as they are played. The act of composition soon became quite frustrating.

As a sequencer it was acceptable, but traditional music notation is not always the most appropriate method for sequencing music. Though the interface was sharp and the response of the program was snappy, this software left quite a bit to be desired.

QuickScore Deluxe would be ideal for those musicians who own a modest PC and would like to occasionally transcribe an item or two. It would also appeal to those with a simple MIDI setup who would like to link their music hardware to their PCs. QuickScore would certainly facilitate some fundamental music education tasks, but as a notation/sequencing program the computer-literate musician would be better off looking at more powerful, and unfortunately, more expensive programs. (Dr. T's Music Software, 100 Crescent Rd., Needham, MA 02194. 617/455-1454)

Graphics and Animation: 9
Sound: 7
User Interface: 7
Overall Play Value: 8

AMI PRO 3.0

Published By: Lotus
List Price: $149
Reviewed By: Woody Liswood

Earlier in the year, *MicroTimes* took a look at several leading Windows word processors (see "Word Processors for Windows," Issue #92). At that time I felt that Ami Pro was the best of the litter. Ami Pro 3.0 still meets my test as the "best" of the Windows word processors.

The first thing you'll notice is the speed. Ami Pro 3.0 seems quicker and more responsive than the older versions.

Drag and drop may be the most important new feature. Drag and drop means that you can highlight a block of text and move it to any new location by moving the mouse pointer, rather than by cutting and pasting. It saves time, keystrokes, and sanity.

Ami Pro's smart icon bar has been improved, even when I thought there was no room for improvement. You can have multiple icon bars—each one set up for different editing situations. The best new feature here is the ability to choose the size of your icons: EGA, VGA, or Small. In the past, when you switched to a higher resolution monitor, Ami Pro automatically changed from small to larger icons, pushing some of icons off the display to the right. Now, you can manually select "small," and keep all of your icons visible on a single icon bar.

Overall, almost every feature in Ami Pro 3.0 is improved, from style sheets and mail merge to fast format and clear screen features. The context sensitive help, for example, is available with a quick click in the upper right hand corner of all dialog boxes.

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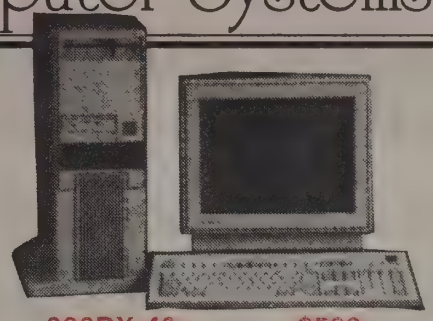

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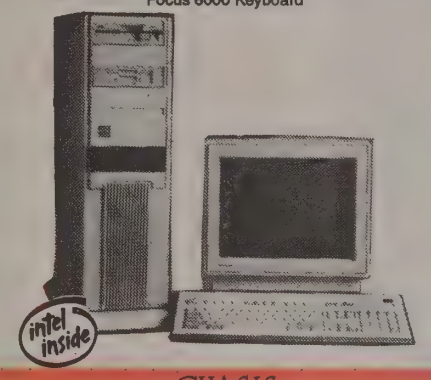

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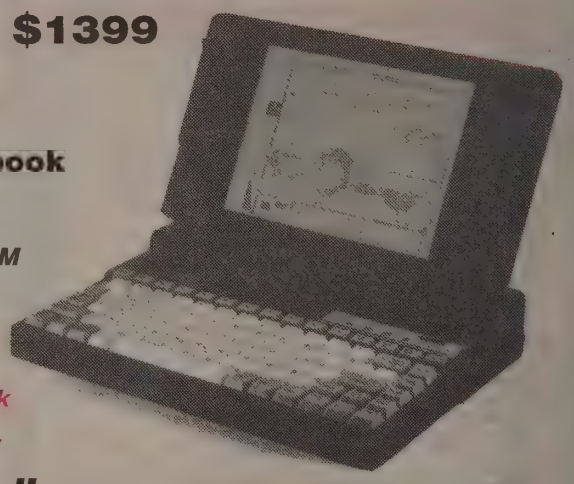

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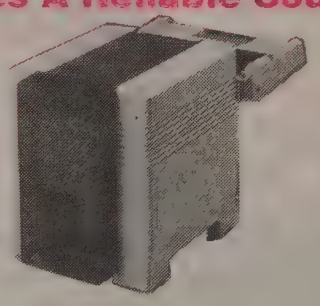

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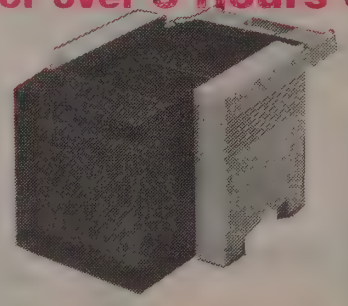

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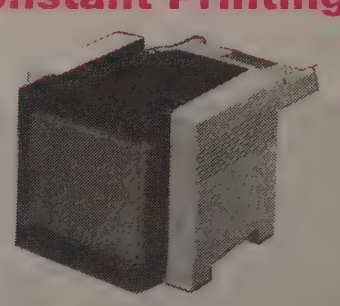

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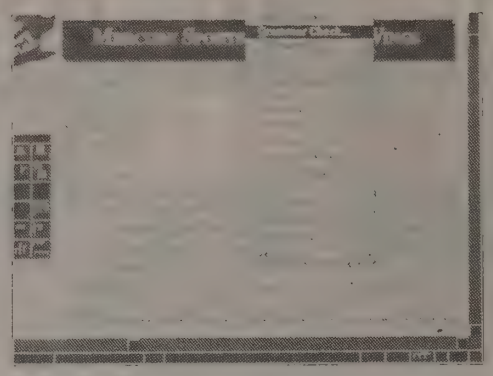

The only problem I had was in loading Ami Pro 3.0. When I first loaded it, it could not find the Thesaurus. I tried three different times, with no luck. A call to Help in Atlanta also produced no results. I tried again, only this time I loaded the automatic tutorial. Guess what: then the Thesaurus appeared as required. Other than that, no problems, no crashes, only quick word processing, the way it was meant to be. (Lotus Word Processing, 1000 Abernathy Rd., N.E., Bldg. 400, Suite 1700, Atlanta, GA 30328. 1-800-831-9679)

TOP PRODUCER

Published By: Top Producer Systems
List Price: $49; multiagent system, $695
Reviewed By: Woody Liswood

Top Producer is designed to be the only program a real estate professional needs.

The built-in word processor has all the basics, such as word wrap and customizable margins, and uses proportional type to print, giving your letters a high-quality, professional appearance.

There is an integrated database. Form letters are as easy to send with Top Producer as with WordStar and its integrated word processing database features. Searching through the databases is also easy. You can find almost anything by name, description, key word, phone number, or company name.

In addition to dialing the phone as part of your prospecting and farming activities, Top Producer includes telecommunications software. Although there is no scripting capability for automating searches or other regularly scheduled activities on your MLS BBS, it is nice to have all this in a single program.

Set up as a PIM, Top Producer lets you look at your scheduled calls, see current listings, what listing activities you plan to complete that day, the follow-up letters you want to write, as well as important dates to remember.

Top Producer presents a screen with the current and future home for each client. It is somewhat simple, covering price range, house type, square feet, number of bedrooms, number of bathrooms, as well as special features. However, this is certainly enough information to let you search through your MLS database to find new listings as they become available. Also, you can add detailed information about the homes, and information abut investment properties already owned by your clients.

Income and expenses are carried as a single item and summarized in month-to-date and year-to-date formats. This should help you track mileage and other tax-deductible expenses.

Top Producer will make everything work better if you are a real estate professional. If you are new to the real estate field, this program contains many of the ideas that are taught at the top real estate firms. (Top Producer Systems, Inc., 110 S.W. 27th St., Renton, WA 98055. 1-800-444-8570)

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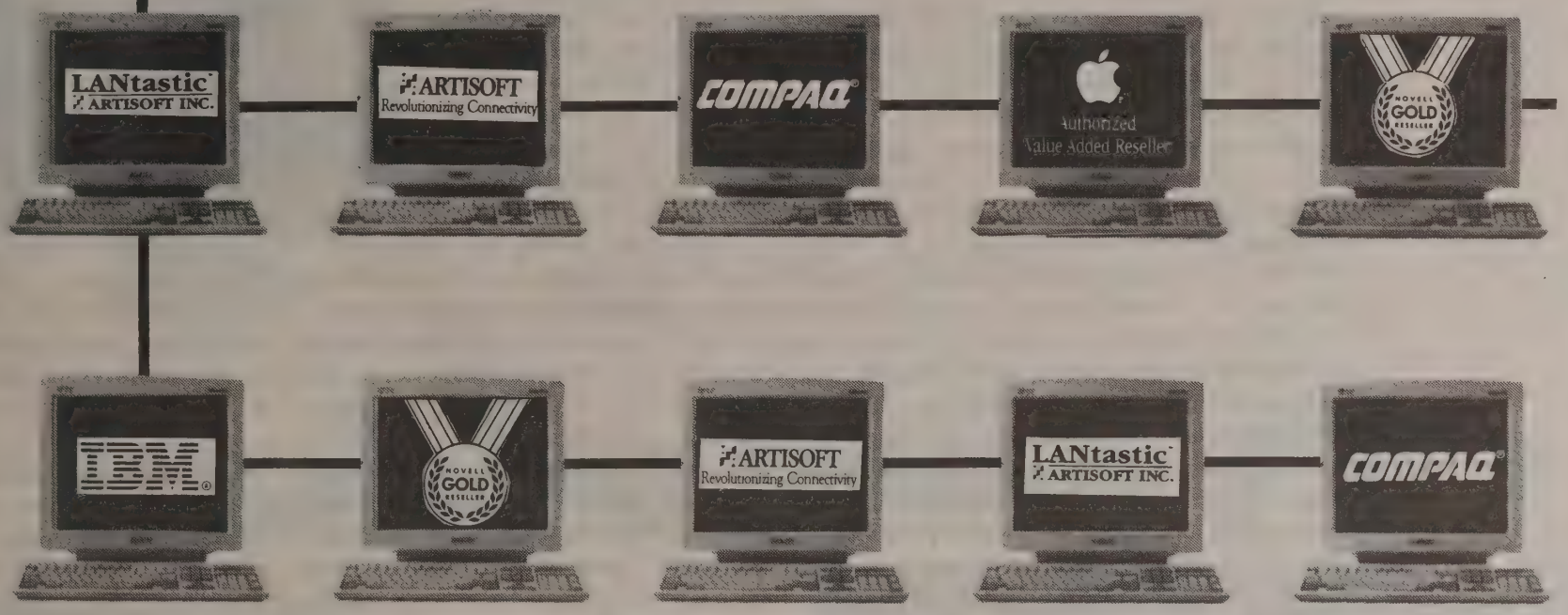

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PRODUCT SPOTLIGHT

BECKER TOOLS 3

Published By: Abacus
List Price: $129.95; special introductory price through October, $59.95
Reviewed By: Woody Liswood

Becker Tools contains a variety of useful utility programs, all running under Windows, that will make your life easier, and perhaps become a lifesaver when a file is accidentally deleted.

This package contains an undelete utility, a file viewer for the popular file types, a text editor, a hex editor, a disk editor, a backup program, a file management shell, a floppy disk formatting and copying utility, a recovery/disk repair utility, and a screen saver with a few displays to keep you amused.

There are so many things that Becker Tools can accomplish; whenever I run Windows, Becker is there, ready to spring into action. The most important feature is undelete. At least once a month, I delete the wrong file, or a series of files. Becker is easy to use, and works as well as any of the DOS undelete programs you may be familiar with.

The recover part of Becker is similar to DOS chkdsk. It will search for unattached strings on your disk and convert them into a file for you to delete to recover space. It will also test your files for readability and physical errors, and attempt to repair any problems.

The Becker shell is more complete and easier to use than the Windows File Manager. Within the shell, you can search, select, and copy files with ease, as well as move and copy files and directories.

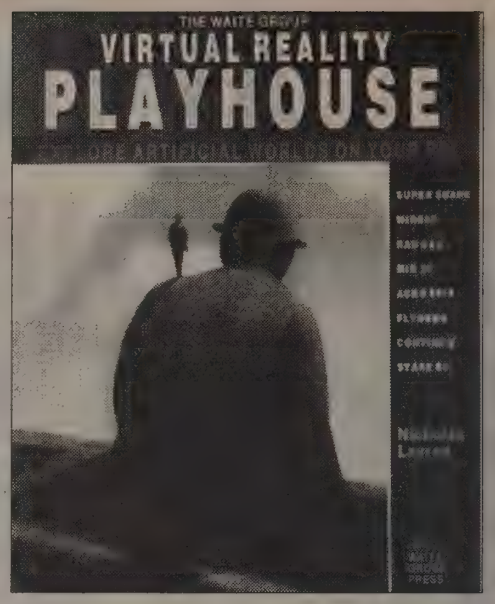
The Becker Backup program is competent. If you don't have a backup program, Becker works very well; it can format on the fly, has compression, password protection, and can back up or restore full or partial file lists.

Versions 1 and 2 of Becker tried to do everything on a single screen. With v3, you get a Becker program group and a series of icons to start up various parts of the programs. This is the way it should have always been. You can now find what you want, rather than try to understand a multiplicity of icons that you couldn't see in the older versions. (Abacus, Inc., 5370 52nd St. S.E., Grand Rapids, MI 49512. 1-800-451-4319)

BOOK REVIEW

VIRTUAL REALITY PLAYHOUSE: EXPLORING ARTIFICIAL WORLDS ON YOUR PC

Author: Nicholas Lavroff
Published By: Waite Group Press
List Price: $22.95



Reviewed By: The Normals

If you still don't know what virtual reality is, or you know just enough to be curious, the *Virtual Reality Playhouse* may be the book for you. The book is divided into two sections. The first section, about thirty-five pages, is an introduction to virtual reality (VR). It has a brief history of VR, a description of input and output devices used in VR systems, and examples of real-world applications. None of these chapters go very far in-depth but they do cover the basics. The second section, about one hundred pages, consists of sample programs and documentation.

A disk with nine programs, each demonstrating different aspects of VR, is included. These are primarily demo programs from different software packages. You can fly in a MiG-29 flight simulator, play a 3-D game with bouncing geometric shapes and definable camera angles, and wander around in sample virtual environments created with the Superscape Visualizer and the Virtual Reality Studio. There are also several different wire frame rotating and creation programs, including one that uses red-blue glasses (also packaged with the book).

For people who like to tinker, there are even instructions on modifying the Nintendo power glove and the Sega 3D LCD shutter glasses for use on an IBM-compatible computer. All of the information and even the software is readily available from other sources, but the VR novice would have a hard time locating it. The book never claims to be the complete guide to Virtual Reality, though—it's a playhouse, and at $22.95 it's a bargain. (Waite Group Press, 200 Tamal Plaza, Corte Madera, CA 94926. 415/924-2575)

THE CUCKOO'S EGG: AUDIO TAPE CASSETTE

Written And Narrated By: Cliff Stoll
Published By: Bantam Audio
List Price: $15.95
Reviewed By: Woody Liswood

The Cuckoo's Egg, by Clifford Stoll, has been reviewed by many publications. It is the story of how an astronomer, assigned to a UNIX

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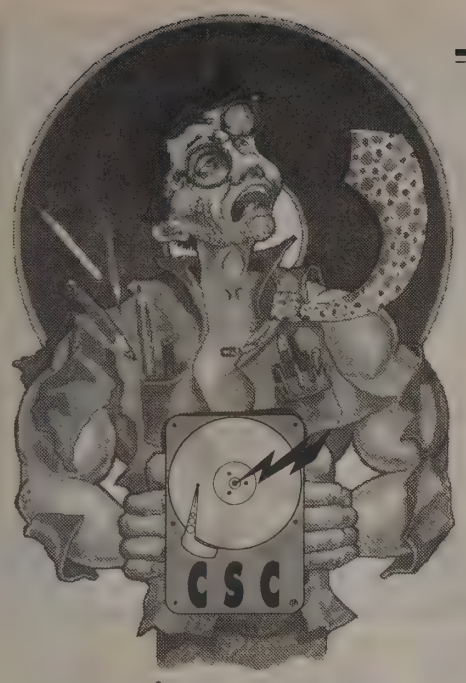

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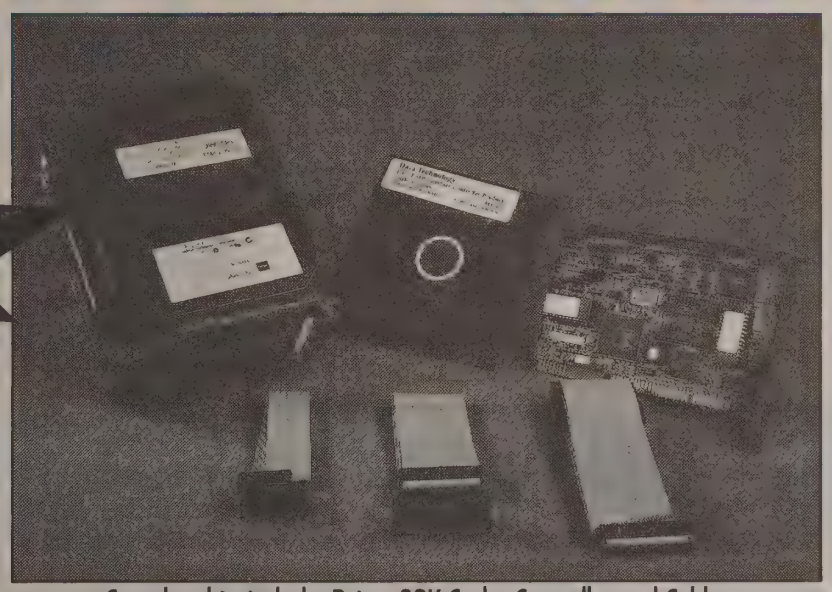

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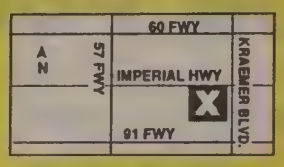

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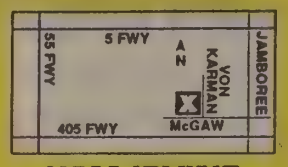

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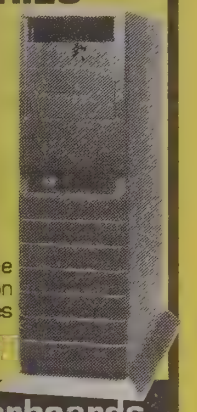

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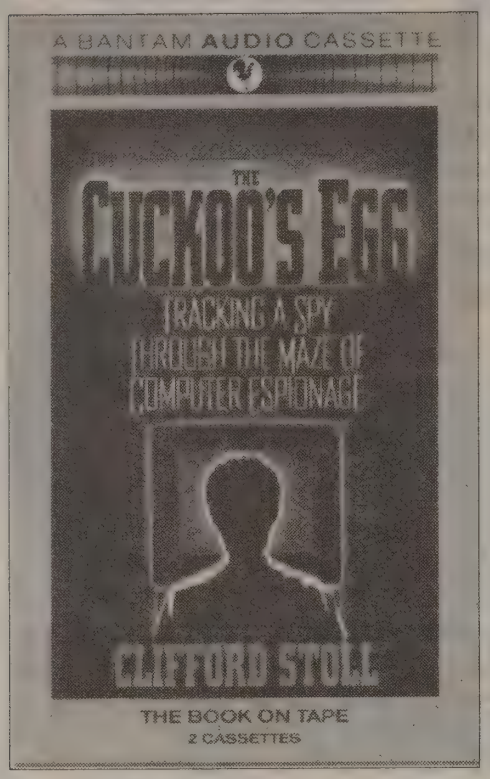

network, tracked down an extensive electronic spy network, mostly by himself, with some help from various individuals.

Recently, I had to drive a U-HAUL trailer from New Jersey to Colorado. A friend of mine, the new vice president of human resources at Bantam, gave me a handful of audio tapes to listen to as I drove across the country. I was doubtful that I would enjoy or even listen to these tapes. My earlier experiences with audio tapes ultimately resulted in boredom.

However, pulling three tons of furnishings and assorted belongings is a tiring venture, and the stories kept me from dozing at the wheel.

The Cuckoo's Egg was the most engrossing of the lot, especially since it was narrated by the author.

If you would like insight into UNIX systems, stubborn-minded perseverance, and the thought processes of a UNIX guru (or should I say nerd), get the book or listen to the tape.

If you are in any way involved in microcomputers, this should be required listening. (Bantam Audio, 666 Fifth Ave., New York, NY 10103. 212/765-6500)

PC HARDWARE

PANPACIFIC COMPUTERS: 486 SYSTEMS

Manufactured By: PanPacific Computer Corp.
Reviewed By: Lenny Bailes

PanPacific Computer has been quietly manufacturing and distributing high-quality motherboards and computer systems for the past three years. Its current crop of 486 systems delivers reliable performance at a low, competitive price. In addition to acting as a distributor for 386 systems, parts, and peripherals, PanPacific manufactures its own 486 machines. Currently, it offers both 33MHz and 50MHz 486 systems, as well as a 25/50MHz 486DX2 system. The systems include the basics offered by most clone vendors, plus VGA video card, mouse, SuperVGA monitor, and 120MB Connor IDE hard drive. All PanPacific systems utilize the leading edge MR BIOS (reviewed in issue #97N). MR BIOS provides virus protection, password protection, and support for 2.88MB floppy drives.

I've tested three generations of PanPacific motherboards, and never encountered a serious compatibility problem. 386 memory managers, Microsoft Windows, and OS/2 work without a hitch right out of the box. The PanPacific motherboards are made in California and include documentation for all hardware features. A separate booklet enumerates the various fine tuning parameters of MR BIOS. (If your video card permits, you can speed up the performance of graphic programs like Windows by choosing a higher bus speed and low wait-state DMA access.) The basic PanPacific 486 systems ship with a 64K static RAM cache, which can be expanded up to 512K. You can also substitute a name brand video card or monitor for the bundled generic ones. (The generic video peripherals should be quite adequate for everyday use: the monitor has a .28 dot pitch, and PanPacific offers three generic video adapters corresponding to the Trident, Paradise, and TSENG 4000 chipsets.)

The systems include unlimited lifetime technical support and a one-year parts and labor warranty. (PanPacific Computer Corp., 165 San Gabriel Dr., Sunnyvale, CA 94086. 408/720-1315)

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The Learn PC Video Series is a comprehensive, self-paced training system that combines videotapes, guidebooks, and an exercise disk to teach students how to use a variety of software applications. The Video Series currently includes training for Computer Literacy, DOS, WordPerfect, Lotus 1-2-3, dBASE, and most of the popular Windows applications. Targeted to high schools, career schools, and colleges, the Learn PC Video Series offers instructors a cost-effective, multimedia teaching methodology. Simon & Schuster, Inc., 1230 Avenue of the Americas, New York, NY 10020. (212)698-7000.

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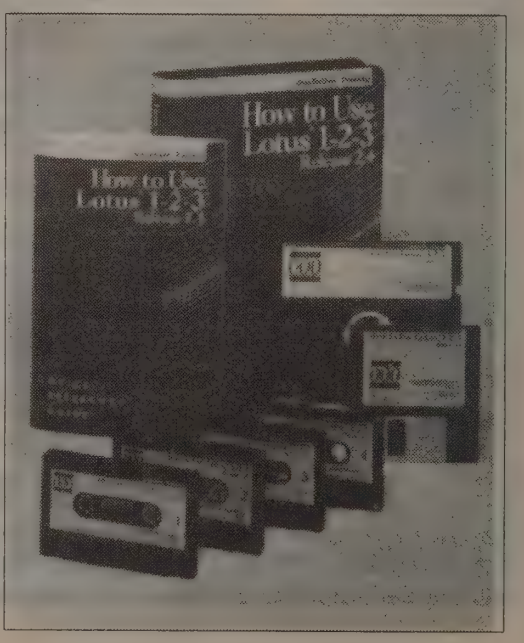

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the world of SmartIcons, WYSIWYG, and mouse control in working with 1-2-3 spreadsheets. The course is presented on four audiocassettes using FlipTrack's patented format. At selected points in each lesson, users can branch to optional topics or get extra practice by flipping the tape. Also included is a comprehensive Quick

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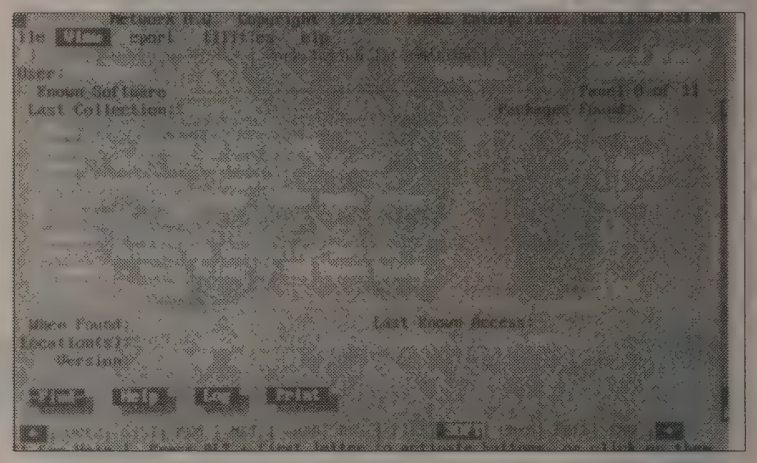
NETWORK H.Q. 2.5

Network H.Q. is designed to automatically inventory LAN workstation configurations. Previous versions have been NetWare specific, but v2.5 will operate on NetWare, LAN Manager, VINES, and most NetBIOS-, NDIS-, or ODI-compatible networks. The new version includes such information as CPU clock speed and MCA and



EISA adapter card information. It will report workstation environments such as Windows, DESQview, OS/2, ROM BIOS manufacturer and version, and NETBIOS version and Bus type. Further, Network H.Q. will report the specific model of 163 of the most popular personal computers. It will also track Macintosh computers connected to a network. (100-pack server license, $395) Magee Enterprises, Inc., 2909 Langford Rd., Suite A600, Norcross, GA 30071-1506. (404)446-6611. MCI: MAGEE.

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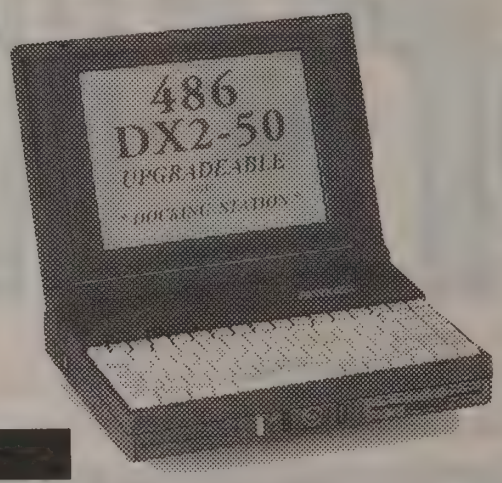

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COMPUTER HOUSE

LaserMaster Laser

Cyrix Cyrix

continued from page 92

plicated. Apple's LaserWriter (for example) was a printer that contained its own powerful computer with a large amount of memory. The LaserWriter was based on the PostScript page description language developed by Adobe Systems Inc. It would take a book to tell you all about how PostScript enables a printer to do all kinds of beautiful and precise things on paper, but for our purposes it will be enough to briefly describe how PostScript fonts work.

PostScript fonts are not sets of little pictures—they are sets of equations that describe the outline of each letter or symbol in terms of Bezier splines, a type of curve that draftsmen love because it is easy to blend one Bezier smoothly into another. Consider the lowercase letter "o". In a modern, geometrical font, this donut-shaped letter could be completely described by two concentric circles, plus the instruction to black-in the space between the circles. In a more traditional font, the circles might become eccentric ellipses, allowing for variation in the thick and thin parts of the letter. But whether you need a tiny 4-point "o" or a monster 144-point "o," it's a simple matter (for a computer) to transform the same basic equations.

Well, it's not actually that simple. Centuries ago, printers learned that small letters need to be scaled and drawn differently from large letters of the same font, to preserve a harmonious visual pattern on the page. Some features of small letters need to be exaggerated to keep them legible. PostScript fonts incorporate "hints" that tell the computer inside the printer how to do this mathematically. PostScript fonts are called "scalable" fonts because they allow letters to be printed at any size from the same basic font information.

There are many other ways to implement scalable fonts. Hewlett-Packard, for example, has its own font architecture, and the HP LaserJet includes two built-in families of scalable fonts: CG Times and Univers (additional font cartridges can be plugged into the printer).

It would be ideal if the same PostScript code that drives the printer could also be used to drive the computer's screen display. Steve Jobs' widely admired NeXT computer does exactly this, using its massive computing power to implement something called Display PostScript. But the Macintosh system architecture was already locked into its own display software, called QuickDraw. QuickDraw insists on having bitmaps to represent text characters, so when you "installed" PostScript fonts on your Mac, you had to include screen (bitmap) fonts, so the computer will have something to put on the screen when you pound the keyboard.

To help meet users' incessant demand for a screen display that would more closely match the printed output, Adobe devised a little startup program for the Mac called Adobe Type Manager (ATM) to provide a sort of simulated Display PostScript. ATM, which is also available in a version for Windows on MS-DOS computers, generates screen fonts from outline fonts "on the fly." It works pretty well.

Reluctant to have such an important part of the Mac's text display and printing capability left in the hands of Adobe Systems, Apple began several years ago to develop an entirely new scalable font architecture of its own called TrueType. TrueType fonts use a cubic splines, a slightly more complex type of curve than the Bezier splines that make up the outlines of PostScript characters. TrueType fonts generate the screen bitmaps and the printer output from the same concise data files. TrueType fonts require a lot more work from the computer, but are designed to work well on "dumb" dot matrix printers as well as "smart" PostScript printers. Perhaps for this reason, Microsoft licensed Apple's TrueType font technology for inclusion in Windows 3.1. For various technical reasons, you can't actually share TrueType fonts between a Mac and a PC running Windows, but the convergence toward a common, universal standard seems to be gathering steam.■

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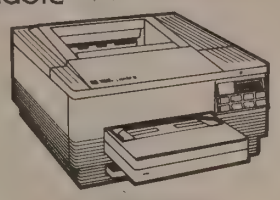

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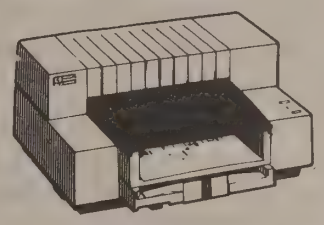

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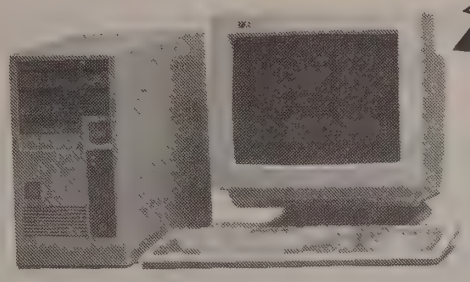

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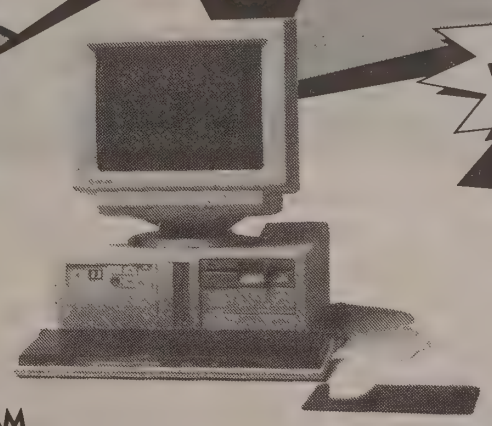

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OTHER PRODUCT ANNOUNCEMENTS

The much awaited A570 also debuted at the show. This turns an A500 into a CDTV unit capable of playing all CDTV titles, audio CDs, CD+G, and CD+MIDI discs. It also has room for 2MB of expansion RAM and provides a rear expansion slot for plug-in cartridges.

Commodore also showed the new A600 computer, a slimmed-down version of the A500, sans expansion slot, aimed directly at the home entertainment market. The A600 features a PCMCIA industry standard expansion connector. With its composite video port, it can be connected directly to a television. Initially, it will be bundled with a host of games. A hard drive version is also available, but will be bundled with more serious software, including a word processor.

Incidentally, Jim Dionne indicated that a CD-ROM drive for the A600 is under development. Also, David Archambault, director of business markets at Commodore USA, stated that while PCMCIA is not initially in the A4000, "the company has a commitment to putting PCMCIA in all of its products."

CDTV units were everywhere in the Commodore booth. Some were showing off the CDXL technology along with the new AVM display adapter, which combine to provide full-color, full-motion, quarter-screen animation straight from the CD. This is quite an achievement considering the notoriously slow transfer rates of CDs. On other PC platforms, people think it's great to achieve lesser performance using a hard drive. Kodak Photo CD compatibility is still in the negotiation phase; however, the software and hardware are ready. Incidentally, current Amiga owners can purchase a CDTV with an Amiga interface for $599.

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COMMODORE'S AGGRESSIVE MARKETING

Commodore is serious about promoting the Amiga and has launched a major print ad campaign targeted at four key professional markets: videography, computer-based training, point-of-information kiosks, and dynamic presentation systems. This includes ads in traditional PC magazines like *BYTE* and *PC World*. One such ad, aimed at the MS-DOS multimedia platform, starts off with: "The MPC version of multimedia may cost more than ours. But it's harder to use and requires more equipment." Commodore knows that the Amiga does multimedia better than MPC, and they want to get the word out.

Commodore is also aggressively trying to increase the Amiga's availability. Jim Dionne revealed that the company is currently negotiating a couple of deals with national reseller chains. Apparently, resellers are interested in the Amiga's profit margin, which has been squeezed to almost nothing for MS-DOS machines.

DIGITAL MICRONICS

I have to mention Digital Micronics' new product, Digital EditMaster. This system provides full-motion JPEG technology, 30-frames-per-second video capture, real-time video display and recording, frame-by-frame recording, full-screen non-linear editing, and SMPTE time code support. Full support for the SunRize audio boards is also featured. JPEG compression is available in rates ranging from 15:1 to 70:1. Digital Micronics' demonstration had an Amiga 3000 grabbing and compressing frames from a video disk to a hard drive, decompressing the files, and then displaying the images on a big-screen TV—all of this on the fly and in real time!

DMI also showed its Vivid 24 graphics coprocessor board. This board, equipped with up to four coprocessors is capable of dramatically reducing things like 3-D rendering for programs written to support it.■

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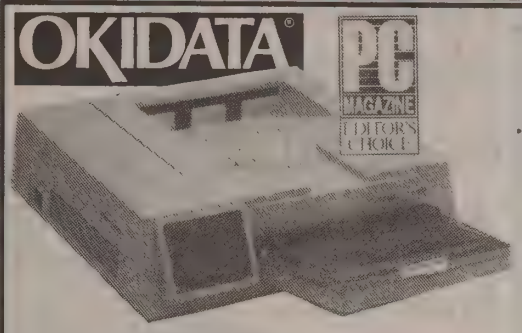

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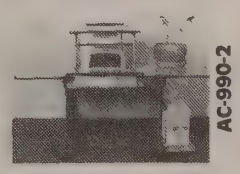

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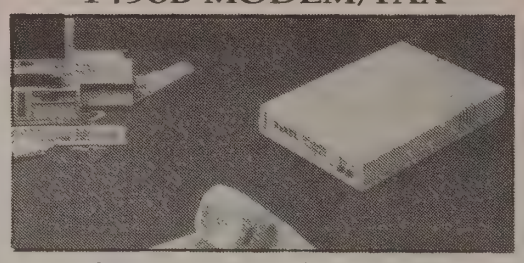

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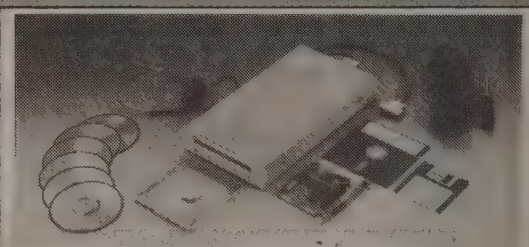

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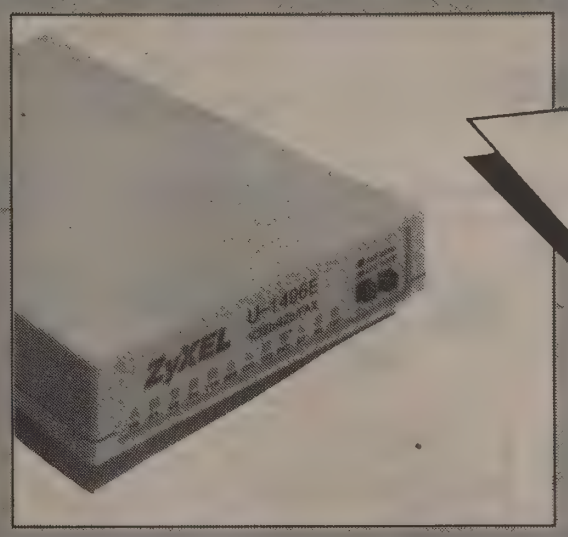

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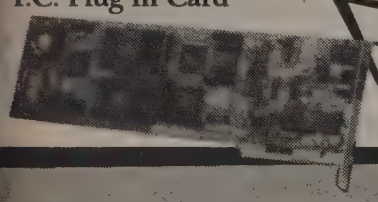

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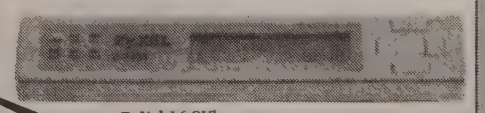

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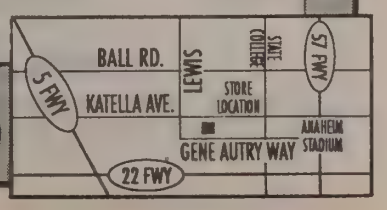

CREATIVE TOOLS

Graphic Databases For The CD-ROM Era

Keeping Track Of Images

BY TONY REVEAUX

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When you buy a package of clip art on floppies, there is usually a printed catalog of the images, and each disk has a certain category on it. But CD-ROMs have so much material, it could take a phone-book-size catalog for all the images.

Dubl-Click Software's "The Wet Set" contains the entire collection of their WetPaint bit-mapped clip art. SunShine's "Visual Delights" has—on one disc—fifty-eight hundred images, many of them wonderfully complex and detailed designs from Victorian times through the twenties. How do you deal with all this largesse?

VISUALIZE PIX

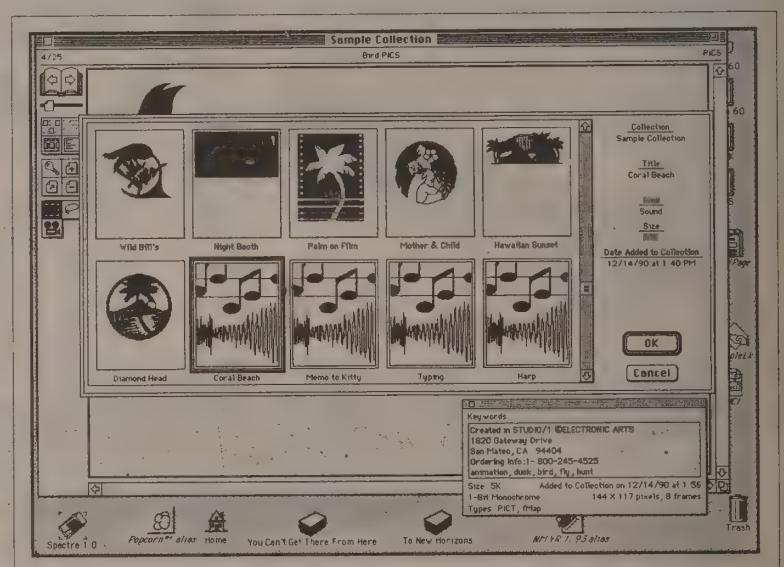
The bible of Mac electronic clip art is the second edition of *Canned Art: Clip Art for the Macintosh*, by Erfert Fenton and Christine Morrissett. This is a 640-page compendium of printouts from commercially available digital clip art, from more than thirty-seven vendors. Images are arranged by vendor and software edition, with background notes, and ordering and pricing information. The book includes a keyword index and covers formats, file management techniques, and utility software. A two-disk sampler of clips from the volume is available for $10 from the publisher. Many of the graphics are compatible for IBM-PCs as well. In the first edition, the authors were able to include printouts of most of the images of each company. Since then, there has been so much expansion, the second edition has just samples from each vendor.

Before CD publishers had to keep track of images for end-users, they had to organize them in-house for their own use. They had to keep track of all of their files, so they adopted off-the-shelf graphic databases or developed their own. Now, most of the clip art CD-ROMs come in a precatalogued format, and include a run-time version of the file management application. SunShine and Pro Art have Multi-Ad SEARCH, and Dubl-Click has—in the same disc—sets in Paint, Mariah, and the old Picture Base formats. They all use the Macintosh hierarchical file format in distributing the data on the disc, under categories such as Fantasy, Landscapes, and People.

Mariah has a "slide show" function that browses through folders displaying one image at a time—but can you imagine going through fifty-eight hundred frames to find what you want? You can search by keyword, such as "camera," "sun," or "sword", and quickly see if there are any images that correspond to your needs. You will have to buy the application to create your own database for your own realms of images, sound, and animations, but these CDs give you the chance to sample them.

MULTI-AD SEARCH

Multi-Ad Search is based upon the Catalog database interface module. You can create as many Catalogs as you want, perhaps one for each project. A single Search query locates an art file from a database containing up to thirty-two thousand separate images whether the art is located on a floppy, a CD, hard drive, removable cartridge, optical cartridge, or mountable tape. This includes files located on servers and concurrent multiuser, up to 128 users. The query response is application independent, but is limited to EPSF, PICT, MacPaint (PNTG), RIFF, or TIFF file formats.



Mariah can catalog and play SND sound files and PICS animation files as well as different graphics formats.

Once you've located the image, you can manipulate it by previewing, printing and copying. The strength that elevates Search above most other graphic databases is its range of search criteria, which can be used in any combination: keywords, filename, file type, volume, and expiration date. You can also create new definitions, e.g. for jobs or sources that can be used for searching. Once a thumbnail image is added, it can be previewed and viewed in enlarged or reduced sizes, though not in the resolution of the original.

Search is able to place images directly into QuarkXpress and Multi-Ad Creator 2.5. But the main weakness of Search is that you can't preview the images in their native locations before selecting them by name in the GetFile dialog box. Mariah is much better for browsing.

MARIAH

Mariah is a full-featured graphic database. It's simpler to use than Search, but it too can support up to thirty-two thousand images in multiple file formats. Mariah is well suited for multimedia applications, since it can support sound and animation files, and incorporates the option of playing SND sound files and PICS animation files

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from within the view windows. The Record%A%Page option brings up a Macintosh system recording panel, which allows you to record sounds directly into Mariah as SND files, if you have a Mac LC, SI, or Performa, or if you have Macromedia's MacRecorder.

If you are using PICS animation files in programs like MacroMind Director and Magic, Mariah can be very useful. But even the latest version of Mariah does not support QuickTime. According to Symmetry, they are working on adding QuickTime compatibility in "the near future."

Unlike Search, Mariah has a Slide Show function which will automatically display one image after another, read from outside files as well as from within its own Collections. The reason for this reflects the main difference between the two database programs: Search is a good flat file database with Boolean search functions, and it maintains speed and efficiency by storing the graphics only as thumbnail

A Mariah Collection file is more portable—it carries the graphics, sound, and animation files with it.

reference files. Mariah adds a copy of each file to a Collection. Thus, if you carry a Search Catalog file outside to another machine, it can tell you the names of the files you want, but you'll have to go back to the host system to get them. A Mariah Collection file is more portable—it carries the graphics, sound, and animation files with it. It may not always fit on a floppy, but it will be complete. Search is better suited to client-server and network environments for multiuser workgroups.

PICTURE THIS 2.0

What do you do when the image you need is not only in another format, but resides in a totally different machine system environment? PICTure This is a graphics file conversion utility that translates many other kinds of files to the Macintosh PICT format. It is especially handy to bring in EPS clip art to non-PostScript programs such as DeskPaint or MacPaint. However, for both Mac EPSF and PC EPS, the resulting PICT will be only the bitmap screen display, which tends to be a very small image that breaks apart immediately as you enlarge even one step. As PICT files, these different format translations can be scaled and manipulated within some Mac graphics programs, but they are used mostly to be included as is in presentations and document preparation. By itself, PICTure This does not support printing.

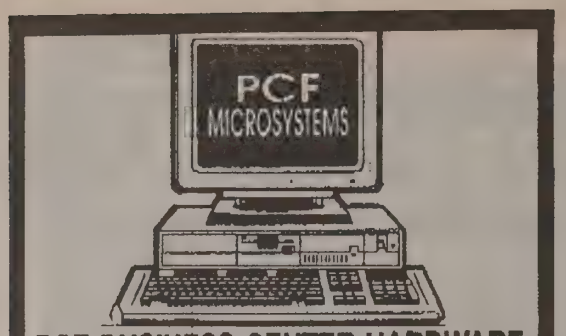
Forgive the laundry list, but it indicates how PICTure This can make it easy to acquire graphic files: Lotus BIT/RLE, Lotus PIC, OS/2 BMP, Windows BMP, GGM, Dr. Halo CUT, Macintosh EPSF, PC EPS, CompuServe GIF, Apollo GPR, Amiga IFF/ILBM, GEM IMG, Visilog IMG, MacPaint, ZSoft PCX, Photoshop, PCPaint PIC, PixelPaint, Silicon Graphics RGB, Letraset RIFF, RIX, Sun Raster, Targa, TIFF, X11 Bitmap, X11 XWD. The program's tutorial includes a folder of "alien" files, such as XWD, SUN, TGA, and PCX. Of course, Mac access to these other formats is achieved by means such as disk media, direct serial cable transfer, or by network and modem.

PICTure This supports the Open Application and Open Document Apple Core Events, where it attempts to determine the format of the target file and invoke the corresponding translator. If the document is a picture file (PICT), PICTure This will attempt to display the picture with its built-in picture viewing utility. The Auto-Sense File Format examines the selected file and displays it in the Format box. If the target file is a folder, PICTure This will examine each file within the folder and try to translate it. PICTure This supports 32-bit addressing and can use virtual memory.

The Macintosh PICT is a QuickDraw Picture Format. Its resolution is output device independent, and will print at the optimal resolution of the printer. The PICT image type is vector and bitmap, a binary page description language. Because it is a language, not a format, PICT has few structuring requirements. This enables it to be a very flexible translator, but you cannot expect the saved translated file to always match the color depth or resolution of the original target file within its host environment. PICT 1 and PICT 2B&W are black and white files, while PICT 2 Color is a color file. In the Translations Options dialog box, you can choose among the three for memory buffer usage size, picture version, resolution, dithering method, and to swap black and white.

PICTure This is a one-way converter, but FGM includes some rough-and-ready "as is" PICT2 utilities that convert Macintosh PICT files to Sun Raster files, various Targa formats, X Windows XWD files, and ZSoft PCX files (sixteen or 256 colors). Transverter is a file translator utility which "transverts" EPS files on the Mac to Paint, PICT, and Draw, and EPS on the IBM-PC to CGM, WPG, PCX, TIF, GIF, or EMF ($49.95; Studio Art, P.O. Box 4258, Las Vegas, NV 89116, fax 702/641-7001).

PICTure This is one of those software tools whose progress always seems to leapfrog their documentation. If you find mysteries and inconsistencies, you will get good help at 1-800-783-7428 or AppleLink D1253.■



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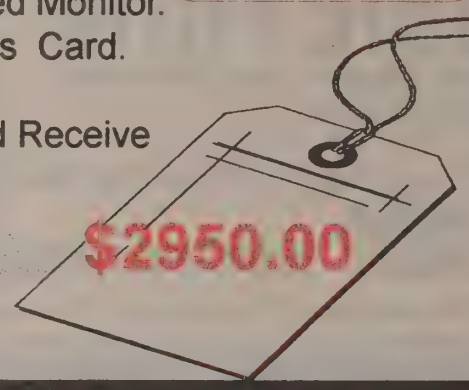

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The Show Circuit: Macworld Boston, MacHack

But No Computers At Cal Expo

BY DAVID MORGENSTERN

In August, the entire family took an excursion to the State Fair at Cal Expo. We enjoyed seeing the animals, betting on the horse races, walking through the endless halls filled with junior crafts exhibits, getting stiff necks on flashy carnival rides, and checking out the many tattoos. The weather was hot! As the day wore on, and we covered every square foot of the fair, it became obvious that something was seriously absent from the exposition—computers.

In the Silicon State, with computer manufacturers, developers, and thinktanks in every community, it's shameful that there was no technology demonstration other than the latest in hot tubs. Even mediocre demonstrations of QuickTime, personal information managers, or multimedia would have blown the baseball caps off this crowd. Is the computer industry so inbred, so complacent, that it can only deal with individuals already addicted to technology?

Most of the people visiting Cal Expo, the same people that you pass on the street or in your car, have never witnessed these cool programs in action. They may have played with their kid's Nintendo, or seen a movie with a computer, but have never witnessed the current crop of personal computers, operating systems, and software. They don't need a glimpse into the future—the software available in stores today will be more than sufficient.

BMUG knows that the only way to appreciate and evaluate computers is to see them yourself and to grill the developers. That's why we have more meetings than any other user group in the world. Please come and join the fun!

BMUG

LOST IN BOSTON: THE POWER TO BE YOUR BEAST

As a parent of a teenager, I'm used to the the nothing's-interesting state of mind. I ask my daughter what happened at school, and get the typical "nothing" response. This is also true of BMUG regulars at Macworld Expositions. They can never seem to find anything interesting at the show. They claim to have seen it all before—usually at BMUG meetings!

But you know there's a serious problem when everyone attending the show, ordinary Macintosh users, sleepwalk up to the BMUG booth with heavy eyelids and complain of catatonia! What was going on?

This was the PowerBook Expo, with loads of products developed specifically for the notebook computers. Although the PBs have been a monster success, not everyone has junked their desktop machines. If you didn't have a PowerBook, the various permutations of tiny video-cards, batteries, and modems held little allure. You could tell the PowerBook owners from a distance—they were listing heavily to the side like a sinking boat, weighed down with the ever-present PowerBook, shrink-wrapped boxes of new add-ons, and the routine ton of Expo handout papergoods.

The BMUG booth was filled with the usual Great Stuff. The latest BMUG Newsletter is packed with dozens of fascinating articles, including a visual aid to what each of the PhotoShop filters does to an image (a real time saver), and even an article on Chinese Feng Shui magic, with an analysis of future Macintosh products. There's even a byte of NeXTrasensory perception.

The Expo saw the introduction of the latest edition of our software encyclopedia, the *1993 BMUG Shareware Disk Catalog.* It's being published by Addison-Wesley and is 686-pages full of the latest entries in the BMUG Library. There are lots of new fonts, HyperCard stacks, and utilities. It's available from BMUG or in your corner bookstore.

Here are some further sights from the Boston Macworld Expo floor:

• Everyone's pick for coolest product at the show was Morph from Gryphon Software. If you haven't been to a science fiction movie in the past couple of years, or watched MTV music videos, then you probably don't know beans about morphing. But when the new model of the Terminator changes shapes, or faces merge into one another in a Michael Jackson video, you're seeing "morphing" in action. In the Gryphon booth, political candidates Bush, Bill Clinton and Ross Perot kept following each other like a nightmare karmic cycle.

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The transition pictures can be kept as a PICT, or as a QuickTime movie, so they can be edited further in a graphics program. This kind of special effects was previously done on highpowered graphics computers, with expensive multi-thousand-dollar software. Morph lists for only $149, so we will be seeing a lot of male merging on desktops this year.

• ShareVision Technology showed a future color video conferencing

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system in the Apple System Software Showcase. ShareVision is a pair of NuBus cards, one with a v.32bis modem, and the other a compression engine, a critical addition when you start tossing around the colossal amounts of data required for video conferencing. The setup also includes a little video camera and a microphone. The ShareVision system doesn't need ISDN or anything fancy (other than itself) and runs over normal phone lines!

On your Macintosh screen you see small windows with the video images, one of you and the other of the person you're talking with. You both can have a document open and edit it together, if the program supports the required AppleEvents. The little video pictures had little shakes and dropouts reminiscent of QuickTime, but you're going to lose something squeezing video, audio, and computer data over standard phone lines.

The company claims that the whole system will only cost $1,500. Does their accountant share that vision?

•If you wanted to pour money into your PowerBook, there were opportunities galore to do so. Color replacement screens and boards to drive external color monitors were very hot—and running a little hot considering the puny power supply in the notebooks.

Microtech International showed the most creative hardware addition to a PowerBook, a solar panel. The device will reportedly list for $189 and attaches on top of the screen, facing up toward the sun. It plugs into the power port and will "extend battery life," but not recharge the battery. Interestingly, it also plugs into the microphone port, which will tell you if the panel is in the best position for getting a tan. The best thing about the panel is that it will double as a shade for the screen, so that it won't wash out in the bright sunlight. Since bright light was scarce on the floor of the show, the performance was difficult to judge.

The BMUG PowerBook Utilities disk was a big favorite of the Eastern power elite. It's available for only $4 from the BMUG office.

Although there were new programs introduced at the show, most of the booths were showing updated versions of software, some that now support QuickTime, AppleEvents, and other System 7 technology. It has taken longer than expected to integrate some of these features into everyday applications. The really innovative stuff was not being shown on the Expo floor—it was a couple of blocks down the street at Apple's System Software Showcase, held in the Boston Computer Museum.

The really innovative stuff was not being shown on the Expo floor—it was a couple of blocks down the street at Apple's System Software Showcase, held in the Boston Computer Museum.

The Showcase was filled with demonstrations of future systemware and products in development that will use these features. Unlike the futuristic technology that we've seen paraded around recently, voice and handwriting recognition, or speech synthesis, these are additions to Macintosh operating systems that will appear on our desktops in the near term. Get used to a whole new vocabulary and alphabet soup with AppleScript (the way users will be able to automate their work), QuickDraw GX (the rewrite of the Macintosh imaging model "the graphics stuff"), WorldScript, and Open Collaboration Environment (a standard way for developers to support electronic mail in their applications). Hopefully we will be able to see some of this technology out on the show floor in the next San Francisco Expo, since some of these technologies will actually ship in 1993. See you there!

TWIST AND HACK

I finally got to grill the members of the BMUG programmers Special Interest Group about the MacHack Conference held last June. This is the premiere programming event of the Macintosh world. Many of the best and brightest Mac talents are in attendance, and it's a working vacation for some of the Blue Meanies, the System 7 technical gurus and arbiters of good taste in coding.

Everything at MacHack is a hack. When a tornado decided to touch down a couple of miles from where the conference was held, it was the "Weather Hack." The determined software-heads kept programming relentlessly on their PowerBooks in the shelter. After lightning struck a tree outside the infamous Machine Room, where all-night programming sessions are the rule, the code meisters did not miss a beat. Neither rain, nor sleet, nor tornadoes, shall keep a hacker from the hack.

There was a bit of evidence that not everyone is thrilled with the way that Apple upper management is heaping the dough into high-profile futuristic system software, instead of half-finished projects of the here and now. System software engineers were heard complaining that advanced technology is getting all the glory and support. A project manager said of speech synthesis and recognition, "There's a project going on inside of Apple that has spent so much money that we could hire someone to stand by each Macintosh and read out loud."

The MacHack contest and award banquet conclude the week's celebration of Mac-ness. Throughout the week, everyone works on little

UPCOMING EVENTS:

September 24	Abacus Concepts, Statview 4.0; NEC Display cards and Accucolor Control System.
September 28	BMUG West at Exploratorium museum in SanFrancisco. Ikegami Color Monitors; Eclectic Software, NetVantage II (Macintosh NetworkSimulator).
October 1	No Hands Software, Magnet 1.0 (filemanagement); WordPerfect Corporation, LetterPerfect and WordPerfect.
October 8	AEC Software, FastTrack; Gryphon Software, Morph.
October 15	Steven Levy, *Artificial Life* (book); Now Software,Now Utilities 4.0.
October 19	BMUG South at United Way Office in San JoseKensington, TurboMouse 4.0 and Numeric Keypad for the Powerbook.
October 26	BMUG West at Exploratorium museum in San Francisco. To Be Announced.

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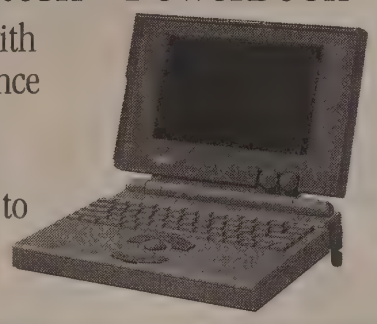

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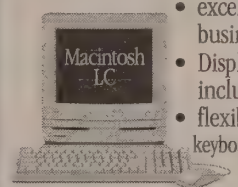

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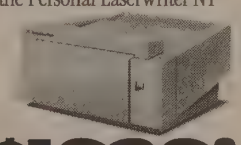

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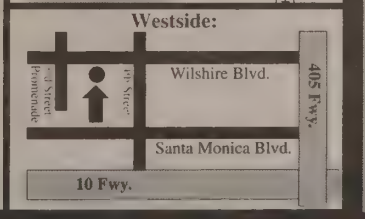

programs that are either brought half-baked to the conference, or written entirely there. The best hacks are saluted and awarded goofball prizes. Here are a few of the choice bytes:

•The winner of the contest was IR-Man by David Falkenberg and Mike Neil. IR-Man is a hardware/software combination that controls a Mac using ordinary handheld VCR or stereo infrared remotes. They showed a VCR controller "winding" and "rewinding" QuickTime movies on a Macintosh. There's a hardware serial device (around $30 in parts) that picks up the infrared signals; then the software analyzes the signal and matches it to the desktop command assigned to that remote control button.

•NetMouseControl is a long name for a very interesting hack. Some lucky Mac users have two monitors on their desktop, side by side. The Macintosh easily understands this kind of setup, and allows you to have one giant virtual desktop across the displays. But what could you do with two Macintoshes side by side—the exact situation of many PowerBook owners?

NetMouse is a pair of extensions that allows you to use one mouse and keyboard for two different Macintosh machines. When you move the mouse to the extreme sides of the menu bar, the cursor moves across the network to the other Mac that you can control. It works as if the two machines shared a single keyboard. It's program-to-program communication in action, in this case the "program" is the Finder!

•The first winning hack by a female programmer was Kathy Brade's Bell Choir. This program simulates a bell choir, using a series of network Macs. A real bell choir is a group of people, each playing several tuned bells. Each player is responsible for particular notes of the scale. As the piece of music is played, each bell ringer hits the assigned notes at the correct musical moment. It's very difficult ensemble playing for humans—not too hard for a Macintosh network.

•BMUGer Leonard Rosenthol and Alex Rosenberg from Apple won fifth place with MovieFinder. It replaces the old "boring" run-of-the-mill static color icons with little QuickTime movies in the Finder. This hack was picked up by a publisher after the conference and will be bundled into some commercial "utilities" package.

•There were many PowerBook hacks, including Strobe, which turns your PowerBook into a very expensive strobe light by flashing the display backlight. Flashback does a similar thing except with a network of PowerBooks. Some of the PowerBook hacks were useful—or a little more useful. Insomnia by Stephan Somogyi waits for you to plug the charger into your PowerBook, and then disables the power-saving Idle mode automatically.

Special thanks to Tom Lippincott, Leonard Rosenthol, and Eric Slosser for allowing themselves to be grilled. ■

Everything at MacHack is a hack.

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WHAT IS BMUG?

BMUG is an educational non-profit consumer advocacy group organized to share information, and provide critical direction to users and developers in the computer community worldwide. It is an independent advocate, not affiliated with any manufacturer, delivering trustworthy information and useful products.

Everyone's pick for coolest product at the show was Morph from Gryphon Software.

Like any growing organization, it is many different things to its 13,000 international members. BMUG supports many Special Interest Groups (SIGs), an eight-line Bulletin Board System (BBS), free HelpLine, software library, weekly meetings, publications, and much more. BMUG also puts out a semi-annual 400+ page book that we call our "newsletter."

Our motto continues to be: *We're in the business of giving away information.*

Come and join in the dialogue at the BMUG main meeting every Thursday evening, 6-9 pm (or whenever we finish), in the Physical Sciences Lecture Hall on the UC campus. BMUG West is a meeting held monthly in the Exploratorium, San Francisco's science museum.

The BMUG Office, 2055 Center St. (a half block from the BART Station) is open to the public 9 am–5 pm. Please come by and say hello, meet other members, and hang out.

The BMUG HelpLine, (510)540-1742, and our fax number, (510)849-9026, provide technical assistance and telephonic hand-holding during business hours (11 am–5 pm). If your question can't be answered on the spot, we try get you in touch with someone that can help. Of course, not every problem can have a happy ending—but we try.

BMUG has one of the most up-to-date, comprehensive software libraries around with hundreds of disks filled with the latest versions of public domain or shareware programs, and HyperCard stacks. New disks are unveiled almost every week at the Thursday general meeting. BMUG also brings you the *TV-ROM*™, a fantastic collection of public domain QuickTime videos.

Our 16-line BBS offers many of the latest versions of files in our software library as well as news, private mail, rumors, etc. The BMUG BBS is part of the worldwide EchoMac Network on FIDOnet (161/444); by calling a local FIDOnet BBS in your area, you would then be able to get in touch with us wherever you are as well as send mail to users everywhere! With our multi-line capability, you can have access to BMUG almost 24 hours a day. It's easy to use, fun, and a great resource.

BMUG can be found on most electronic services. BMUG can also be reached through the international USENET network through bmug@garnet.berkeley.edu.

To get some further information about BMUG please write to: BMUG, 1442A Walnut St., #62, Berkeley, CA 94709. If you prefer to phone our business office call (510)549-BMUG, or fax (510)849-9026. ■

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Calendar Of Events

CONFERENCES, SHOWS AND OTHER SPECIAL EVENTS

OCTOBER

October 10–11 Computer Show. LA Fairgrounds, Pomona. Computer Marketplace. Call: 1-800-800-5600.

October 11 Computer Show & Sale. San Diego. MarketPro Shows. Call: (415)388-8893.

October 11–14 1992 Human Resources Executive Forum. Laguna Niguel. Spectrum Human Resources Corp. Call: (303)534-8813.

October 14–18 International Computer Music Conference. San Jose. ICMA. Call: (408)924-4675. Email: icma@sjsuvm1.bitnet.

October 17 Computer Show & Sale. Ventura. MarketPro Shows. Call: (415)388-8893.

October 17 Computer Show & Sale. CSUN, North Campus. Richard James Corp. Call: 1-800-433-7469.

October 18 Computer Show & Sale. Glendale Civic Auditorium. Richard James Corp. Call: 1-800-433-7469.

October 20–23 AIX Expo '92. San Jose. International Technology Group. Call: (415)964-2565

October 21–22 PenLABS Seminars. Redwood Shores. CIC and MicroAge. Call: 1-800-888-8242.

October 25 Computer Swap Meet & Computer Fair. Fullerton College. NOCCC. Call: (714)998-8080.

October 26 Second Industry Symposium On Virtual Worlds Technology. HIT Labs, Washington. HIT & Univ. of Washington. Call: (206)543-5075.

October 26–28 Third Annual XDB User Conference. Baltimore. XDB Systems. Call: 1-800-488-4948 ext. 501.

October 31 Computer Show & Sale. Anaheim Stadium—Indoors. Richard James Corp. Call: 1-800-433-7469.

NOVEMBER

November 4–6 The 1992 Computer Graphics Summit Conference. Catalina Island. Computer Graphics Summit. Call: (310)374-5156.

November 7 Computer Show. LA Fairgrounds, Pomona. Computer Marketplace. Call: 1-800-800-5600.

November 8 Computer Show. Sherman Square Entertainment Center, Reseda. Computer Marketplace. Call: 1-800-800-5600.

November 9–13 Synergy '92 Conference. Anaheim. Weingarten Publications. Call: (617)542-0146.

November 14 Computer Show & Sale. CSUN, North Campus. Richard James Corp. Call: 1-800-433-7469.

November 15–19 ASM '92: 3rd International Conference On Applications Of Software Measurement. La Jolla. Software Quality Engineering. Call: 1-800-423-8378.

November 16–20 Comdex/Fall '92. Las Vegas. The Interface Group. Call: (617)449-6600.

November 22 Computer Show & Sale. Glendale Civic Auditorium. Richard James Corp. Call: 1-800-433-7469.

November 28 Computer Show. LA Fairgrounds, Pomona. Computer Marketplace. Call: 1-800-800-5600.

DECEMBER

December 5 Computer Show & Sale. CSUN, North Campus. Richard James Corp. Call: 1-800-433-7469.

December 6 Computer Show & Sale. Orange County Fairground. Richard James Corp. Call: 1-800-433-7469.

December 19–20 Computer Show. LA Fairgrounds, Pomona. Computer Marketplace. Call: 1-800-800-5600.

CLASSES, SEMINARS AND WORKSHOPS

OCTOBER

October 10 Beginning Lotus Class. Monrovia. The Organizers. Call: (818)303-3311.

October 14–16 Wireless Personal Communications Networks Short Course. Los Angeles. UCLA Extension. Call: (310)206-2815.

October 17 Intermediate Lotus Class. Monrovia. The Organizers. Call: (818)303-3311.

October 17 Intermediate WordPerfect Class. Monrovia. The Organizers. Call: (818)303-3311.

October 24 Lotus For Windows Class. Monrovia. The Organizers. Call: (818)303-3311.

October 26–30 A Preview Of 4.4 BSD UNIX Kernel Internals: Implementation, Tuning And Networking Course. Los Angeles. UCLA Extension. Call: (310)825-3344.

NOVEMBER 7

COMPUTER SHOW

Pomona

Computer Marketplace computer shows feature hundreds of exhibits with thousands of products. Admission is $6.00 and shows are from 10:00 am to 5:00 pm. Los Angeles County Fairgrounds (Fairplex), Pomona. Call: 1-800-822-5600.

OCTOBER 21

COMPUTER SHOW & SALE

Anaheim Stadium, Indoors

The Richard James Corporation presents one of the largest, one day computer show's in California. The show features hundreds of exhibitors, including direct importers and manufacturers, selling at prices that make it possible for you to purchase the latest software or hardware for up to 80% off retail cost. Admission is $6 and shows are from 10:00 am–4:00 pm. Call: 1-800-533-7220.

October 31 Advanced Lotus Class. Monrovia. The Organizers. Call: (818)303-3311.

October 31 Advanced WordPerfect Class. Monrovia. The Organizers. Call: (818)303-3311.

NOVEMBER

November 2–4 Distributed Computing Systems: Multi-Vendor Information Technology Networks Seminar. Los Angeles. UCLA Extension. Call: (310)825-1047.

November 2–4 Distributed Computing Systems: Multi-Vendor Information Technology Networks Short Course. Los Angeles. UCLA Extension. Call: (310)206-2815.

November 2–4 MACH: The OSF/1 Core Kernel Course. Los Angeles. UCLA Extension. Call: (310)825-3344.

November 16–17 Database/Word Processing Software Workshop. Los Angeles. Symantec Training Group. Call: 1-800-786-8620.

November 18–20 Project Management Software Workshop. Los Angeles. Symantec Training Group. Call: 1-800-786-8620.

DECEMBER

December 7–9 Prototyping And Rapid Application Development Seminar. Los Angeles. DCI. Call: (508)470-3880.

December 15–18 Intro To ISDN Course. Los Angeles. Learning Group International. Call: Kim Sisson, 1-800-421-8166.

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October 10 & 11, 1992 SATURDAY & SUNDAY
L.A. Fairgrounds (Fairplex), Pomona

November 7, 1992 SATURDAY
L.A. Fairgrounds (Fairplex), Pomona

November 8, 1992 SUNDAY
Sherman Square Entertainment Center, Reseda

POMONA SEMINAR SCHEDULE

SATURDAY-OCTOBER 10

TIME	SEMINAR
11:00-12:00	Intro. to Word Perfect Grow your Business by Planning Intro. to Computers
12:30-1:30	Intro. to Lotus 1-2-3 Intro. to Local Area Networking Intro. to Windows 3.1
2:00-3:00	Intro. to Computers Dictionaries, Parsers & Translators Intro. to Word Processing
3:30-4:30	Intro. to Dos/WIndows Manufacture & use of Floppy Disc Intro. to Spreadsheets

SUNDAY - OCTOBER 11

11:00-12:00	Intro. to dBase Computer Consulting for Profit Intro. to Graphic Software
12:30-1:30	Purchasing and Maintaining Computer Hardware Personal Professors in Computers and thier $1000 reward Desk Top Publishing
2:00-3:00	Intro. to Word Perfect How to grow your business Dos 5
3:30-4:30	Lotus 1-2-3 Intro. to Local Area Networking Intro. to Computers

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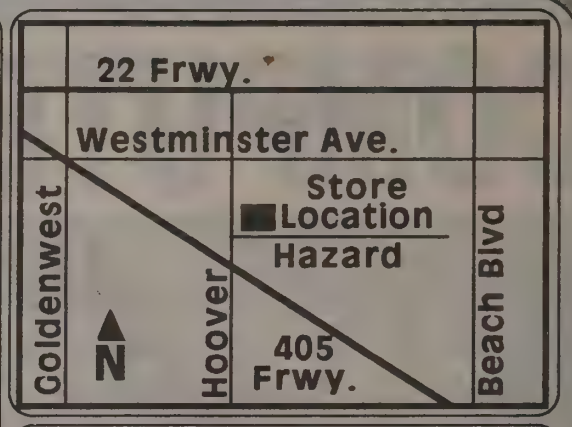

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IPM 386DX/25/ 33/40MHz

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- MB 386DX w/4 MB Memory
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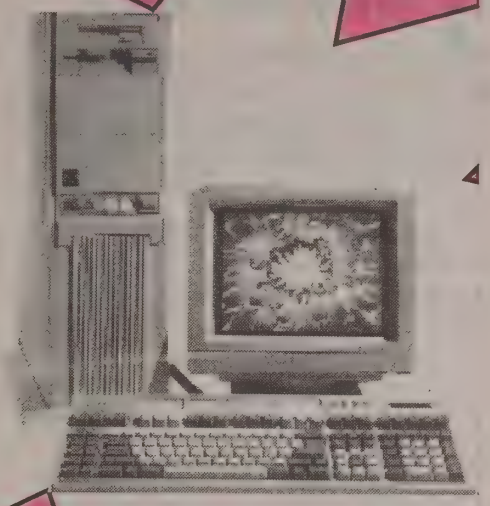

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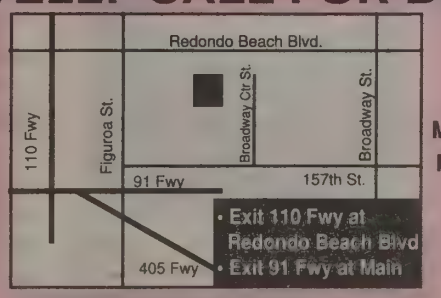

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386SXL-25	NP925, 2MB/80MB	$ 1495

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- ▲ Car adapter
- ▲ Fax/scanner
- ▲ Ext FDD/RS-232
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- ▲ Ethernet (LAN)
- ▲ 2nd Serial port
- ▲ IBM 3270 Emulation
- ▲ Modem
- ▲ SCSI interface
- ▲ Quick Charger
- ▲ Others

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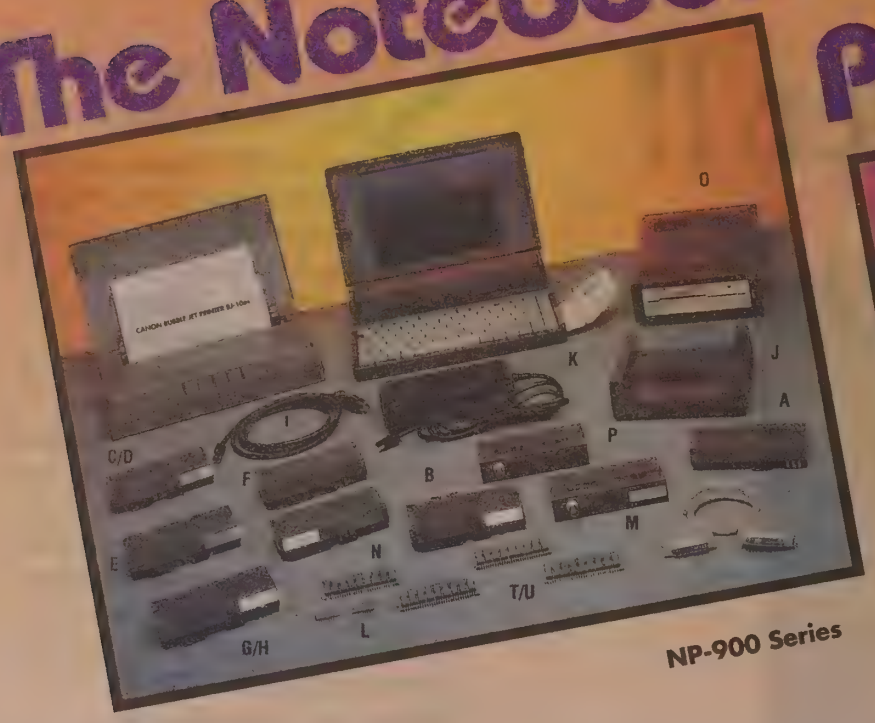
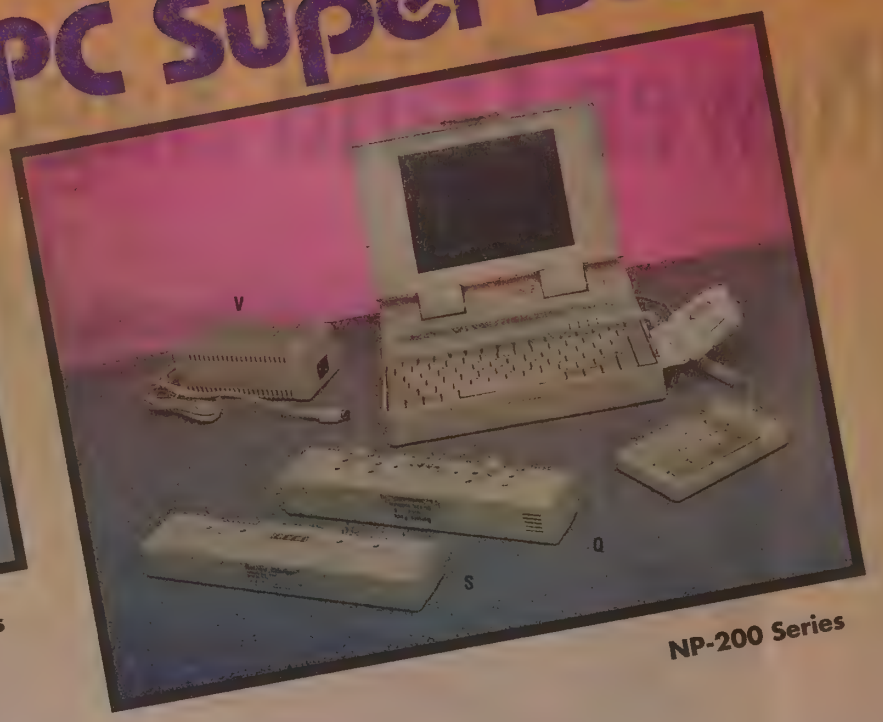


NP-900 Series



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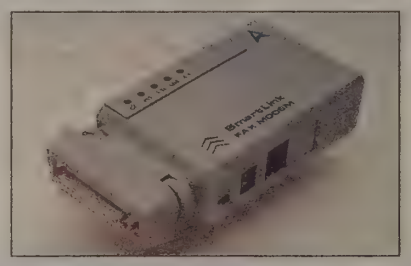

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NB	PC	Colorado Trakker External 250MB Tape Drive	$ 479.00
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NB	PC	Z-Nix Portable Track-Ball Mouse (Serial)	$ 65.00
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	PC	Thunder Video Card-Video image Grabber/win	$ 389.00

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NB	PC	Honeywell 101 Win (3yr. Warranty)	$ 40.00
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NB	PC	NANAO 21"SVGA F750i, LR, FS, NI	$2150.00

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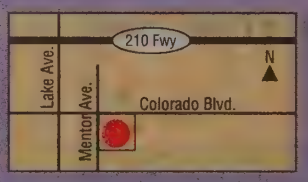
	PC	Diamond Stealth 1MB	$ 264.00
	PC	Westen Digitd Graphics Accelerator w/1MB	$ 139.00



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USER GROUP NETWORK

BULLETIN BOARDS

213

AAC-Info Net. (213)294-9729. 8-N-1, 300/1200/2400. New Afro-American news, information, messages, and public forum. Sysop: Selmo Belisle. [Exp. #101.]

The Career Network. (213)623-8503. 5 pm–12 am, 300/1200/2400. Job hunting. Now your resume can reach over 250 major employers each month. Sysop: Steven McCormick. [Exp. #102.]

The Communication-FAX-Link. (213)384-4394. Messages faxed. Free, donations accepted. Voice: (213)384-0325. Sysop: Eric Schwartz. [Exp. #101.]

Diversity Infinite Combination: The BBS. (213)296-6755. 10:00 pm–6:00 am, 300/1200/2400. This board is for writers, artists, and Star Trek clubs. Sponsored by Infinite Savant Publishing and Sundance Writers' Guild. [Exp. #101.]

LAAUGLine. (213)387-1002. 24 hrs., 300/1200/2400. Amiga. Sysop: Thom Irwin. [Exp. #102.]

Megabytes BBS. (213)221-6379. 8-N-1, 300/1200/2400. Specializing in Windows 3.x shareware. Sysop: William Rivas. [Exp. #102.]

UFPSS Friendship BBS. (213)936-1432. 10 pm–8 am, 300/1200/2400. For writers, artists, RPGers, and ST/Sci-Fi fans. Part of the IDIC-Net. [Exp. #101.]

US Pompeii. (213)878-2801. Local numbers avail, email, pubs & forums, chat, libraries, and games. [Exp. #102.]

310

A-American BBS. (310)305-0441. 8-N-1, 24 hrs. 300/1200/2400/9600. Programming, scientific, Ham radio, scuba, adult images, jobs, entrepreneurial forums. Sysop: John Lewis. [Exp. #102.]

Amulet BBS. (310)453-7705. 24 hrs., Specializing in xBASE and cyberspace. Free. Sysop: Dan D. Gutierrez. [Exp. #101.]

Citizen America BBS. (310)453-7564. 8-N-1, 24 hrs., 300/1200/2400. Support for Citizen printers & computers. Sysop: Citizen America. [Exp. #102.]

The Bad Boy BBS. (310)915-8590. 24 hrs., 300/1200/2400. Ham radio, SWL, scanner info. OCAPS approved. Access first call, free. Sysop: Danny Barker. [Exp. #103.]

Compu-Net! BBS. (310)823-3609. 300/1200/2400/9600. 1GB, 15 separate systems in one call. Adult, finance, sports, Windows, occult, IBM, and more. [Exp. #101.]

Computer RAP Center BBS. (310)436-8944. 8-N-1, 24 hrs., 300/1200/2400. Upload-download free, good software. Sysop: Kenny. [Exp. #101.]

The Connection BBS. (310)793-0994. 24 hrs., 300/1200/2400. Msg. bases, PD files, QB and VB Programmers, Novell topics, and more. [Exp. #101.]

Consultant's Link. (310)379-9070. 8-N-1. Database for consultants looking for employment. [Exp. #101.]

Cosmos. (310)539-3078. 7:30 pm–7:30 am. 2400. One line, WWIV software, subs, huge file section. Sysop: Gabriel Hayes and Wayne Pan. [Exp. #103.]

Digital Visions. (310)408-0490. 8-N-1, 24 hrs. GIF images, Raytracer programs, Special EFX Animation created by the sysop and users. Free sample files. Sysop: Dion Kraft. [Exp. #102.]

Drug Abuse Information (DIAMP). (310)825-3736. 8-N-1, 24 hrs., 300/1200/2400. Drug information, statistics, bibliographies, forums, email, downloads, and uploads. Free membership, reg. requested. Sysop: Greg Cason. [Exp. #101.]

The Forbidden Zone. (310)929-4460. 24 hrs., 300–16,800. 20MB PD transfers, games, taboo msg. base, fees optional. Sysop: Beltair [Exp. #101.]

The Great CHR$(27). (310)693-7907. 24 hrs., 1200/2400. 12 Steps, BASIC Programming, C, TECH Talk. No fees. [Exp. #102.]

Guilded Globes. (310)594-0505. 8-N-1, 300/1200/2400. AD & D, WWIVnet, debates, online games, active users, many msg. subs. Free reg. Sysop: Physicist. [Exp. #101.]

Hatch.uucp. (310)822-3970. 1200/2400/9600. Usenet feeds, 1200 Newsgroups, worldwide internet email, domain addresses avail. Sysop: Mike Barnadett. [Exp. #101.]

Kluged—The Anarchist's BBS. (310)432-5305. 8-N-1, 24 hrs., 300/1200/2400. Open to anything. Shareware, games, programs, graphics, and message base. Free. Sysop: Martin. [Exp. #102.]

La Mirada's The Modems Delight BBS. (310)944-1221. 24 hrs., 300/1200/2400/9600. Multi-interest files, doors, games, and fun. Running Telegrad BBS v2.7, BlueWave Echo-mail, 1:102/430 Fidonet. Sysop: Ronald Dishon. [Exp. #103.]

LA Computer Society BBS. (310)475-8720. 8-N-1, 24 hrs., 2400 only. Full access to Computer Society members ($36/yr), message bases, SIGs, and club information. Sysop: Debbie Rhodes. [Exp. #101.]

LAMG (Los Angeles Macintosh Group). (310)559-MACS. 8-N-1, 24 hrs, 300/1200/2400/9600. So. Cal's busiest all-Mac multiline BBS. 300MB+ of Mac news, reviews, rumors, and more. [Exp. # 102.]

the original off off-broadway BBS. (310)453-7038. 8-N-1, 24 hrs., 300/1200/2400/9600. Non-subscription, text files/messages only. Using MajorBBS software and CompuCom Speedmodem. Sysop: James Gossage. [Exp. #102.]

One World. (310)372-0987. 8-N-1, 300/1200/2400/9600/14,400. Ecology, gardening, health, alt. news, int'l network. Free. [Exp. #101.]

The Profit Quest BBS. (310)318-1413. 1200/2400. Networking the small- and medium-sized business community. Free. Sysop: John Fransosky. [Exp. #103.]

The South Bay BBS. (310)219-1276. 300/1200/2400. Free, instant access, new. Sysop: Tony Hughes. [Exp. #102.]

South Bay Commodore Users Group (SBCUG). (310)643-8818. 24 hrs., 300/1200/2400. Graphics and library. Sysop: Jeffery Baldwin. [Exp. #102.]

619

Big Sky BBS. (619)368-0997. 8-N-1, 24 hrs., 300/1200/2400/9600/14,400. 810MB online, TAG, Amiga and IBM files and programs, Fred Fish, music, adult. Online first time. Sysop: Larry Wieland. [Exp. #102.]

Satang BBS. (619)364-0033. 8-N-1, 24 hrs., 300/1200/2400. 170MB online, Wildcat! IBM files & programs, religion and metaphysics. Sysop: Ed Shimko. [Exp. #102.]

Techpro BBS. (619)755-7357. 300/1200/2400/9600/14,400. San Diego technical jobs. *USA Today, Boardwatch, Microbytes Daily.* 100% free. [Exp. #103.]

714

Astronomer's BBS. (714)738-4331. 2400. Digitized space images, NASA news, piggyback AMSAT BBS, daily satellite GIFs. Sysop: Walter Clark. [Exp. #102.]

The Central Office Public Data eXchange. (714)840-2437. 24 hrs., 300–14,400. Telecommunications, off-highway vehicles, Baja California/Mexico. Three BBSes in one, each independent. [Exp. #102.]

Commodore Automated Terminal BBS. (714)979-8333. 24 hrs., 1200/2400. C64/128 help, private mail, email, online games. [Exp. #103.]

Commodore Computing. (714)673-2185. 8-N-1, 24 hrs., 300/1200/2400. 64/128. Tech support and games. No reg fee. Sysop: Stephen Fabre. [Exp. #103.]

DIASPAR VIRTUAL REALITY NETWORK

By John Wolcott

The Diaspar Virtual Reality Network is a rare find. It is not any ordinary BBS. Located in Laguna Hills, it is probably worth any toll or network charges you may incur. Oriented toward an educational platform, it offers a variety of features that will please most any BBS user.

The new twist featured in this network is a growing library of books and articles for download by system users. Reading a science fiction novel from your computer screen can be a nice diversion from normal computing tasks when a break from monotony is required. Currently available in the fiction library is a full novel, *Fallen Angels*, written by Larry Niven, Jerry Pournelle, and Michael Flynn, published by Baen Publishing Enterprises.

Logging onto the network is straightforward. On-screen menus guide you through the features. When you select the Virtual Emporium choice, browsing through titles is simple with special keys for scrolling and selecting choices; similar to a UNIX editor. The special key commands are displayed on every menu screen, avoiding any mystery in operation. System Operator David Mitchell is eager to assist users and has great plans for system expansion with new features and more book titles.

Importing the file into a word processor is necessary to read the book on screen. This yielded 336 pages of text, an awesome job for any printer if you're inclined to have it in a printed format.

The Diaspar Virtual Reality Network is accessible at 2400 baud by calling (714)811-9101 or 9600 baud by calling (714)362-9995. It is also available through subscription on SprintNet's PCPursuit. Direct dial network subscription offers the first 30 days free to try out the system. Thereafter, it's $10.00 for three months in addition to minimal file download charges. You may also access their download services in the Virtual Emporium without being a subscribing member, after your account information has been verified.

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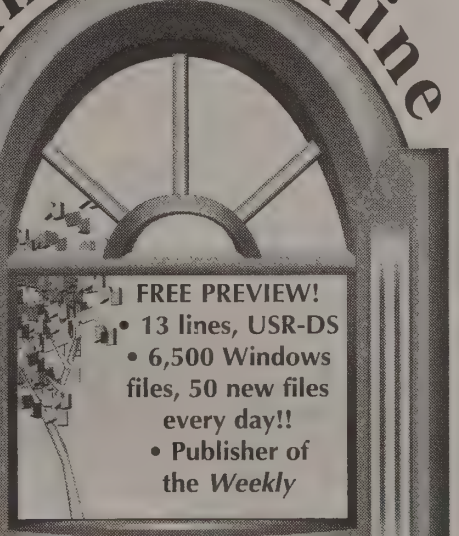

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Diaspar Virtual Reality Network. (714)831-9101 (2400), 362-9995 (9600). Home EduTainment Center, 20+ lines, experience virtual reality. Sysop: David Mitchell. [Exp. #103.]

The Drop Zone! BBS. (714)245-3854. Games, utilities, adult GIFs, nationwide echo-net, 1.2GB online. Reg required. Sysop: Rick Simmons. [Exp. #103.]

Easy Street. (714)590-4307, 778-5473. 8-N-1, 24 hrs., 300/1200/2400/9600. 20,000+ files, adult fun, 42 lines w/local access throughout Orange County. [Exp. #102.]

The EinStein Pub. (714)991-9752. 10 lines, user friendly, email, live chat, trivia, library, programming help, socializing, special events. [Exp. #101.]

The Master Connection BBS. (714)651-9815. 24 hrs., 1200/2400/9600. Lots of games, utilities, graphics. No fee. Sysop: Mark Duvall, Jr. [Exp. #103.]

Free Money Manager BBS. (714)642-7627. 8-N-1, 1200/2400. Download free version of Tree Based. [Exp. #102.]

The French Connection. (714)993-6200. 300/1200/2400/9600. 32 chat lines, online SIGs, msg bases, networked, organized socials, subscriptions, discount for couples & military. [Exp. #102.]

The Hotline BBS. (714)857-0233, 256-8672. 8-N-1, 24 hrs., 300/1200/2400. PD software, matchmaking, 16 chat lines, social events. Sysop: John Coon. [Exp. #101.]

Infinity BBS. (714)379-1335. 16 lines, one GIF file library, teleconference, games, email, and current satellite weather pics. Sysop: Eric Robitaille. [Exp. #101.]

The League BBS. (714)979-9230. 8-N-1, 24 hrs., 1200/2400/9600/14,400. Multi-node chat, CyberNet echomail, 1.4GB, IBM shareware, Windows 3.x apps/utils. Sysop: Nathan Renich. [Exp. #101.]

MacShack BBS. (714)373-0656. 24 hrs., 2400. Mac, amateur radio, consumer interest. Sysop: Dude B. Narley. [Exp. #101.]

Midnight Mission BBS. (714)848-6808. 24 hrs., 300–14,400. Large game and GIF file areas. Full access with call back. Sysop: Marty Strech. [Exp. #101.]

Music Insider BBS. (714)992-2721. 24 hrs., 1200/2400. For the pro: songwriter, musician, MIDI user, and player. Electronic "tip sheet," w/40+ major recording artists currently looking for material. Sysop: Douglas Boughter. [Exp. #103.]

Online Exchange. (714)870-4614. 2400–14,400. Shareware, large adult GIF file area, games, 2.5GB online. Sysop: Bob Aune. [Exp. #102.]

The PC Sports Connection. (714)533-6728. 8-N-1, 24 hrs., 300/1200/2400. Using Searchlight for unique games, fantasy leagues, and sports talk. Sysop: Keith Jefferson. [Exp. #102.]

Sherlocktron. (714)492-0724. 8-N-1, 24 hrs., 2400. Sherlock Holmes BBS with lists of societies, publications, and purveyors. Sysop: Willis G. Frick. [Exp. #101.]

Starbase Atlantis. (714)871-8810. 1200/2400. Fun for all, esp. Tradewar players. Sysop: James Wihardja. [Exp. #103.]

The Storage Power BBS. (714)952-8666. 8-N-1, 300/1200. Specializing in Radio Shack models I, II, III, IV, 12,16, and 6000. [Exp. #101.]

Trixie's Doghouse. (714)499-2864. 8-N-1, 24 hrs., 300/1200/2400/9600/14,400. Specializing in topics related to pets. Full access with callback. Sysop: Jason MacDonald. [Exp. #102.]

WinSIG BBS. (714)363-9802. 24 hrs., Windows 3.xx shareware. Sysop: Firas Bushnaq. [Exp. #102.]

805

The Delphic Oracle. (805)582-9004. All-gaming BBS: play RPGs, play-by-email games, "Empires at War." Find modem-game players. Gamemasters, players wanted. Free access. Sysop: Martin H. Fryc. [Exp. #101.]

Farpoint BBS. (805)582-1621. 8-N-1, 24 hrs., 1200/2400/9600/14,400. IBM shareware, adult files & GIFs, NETMail, online games, 700+MB. Free after reg. Sysop: Gary Bisner. [Exp. #101.]

Revelation BBS. (805)296-1218. 24 hrs., 1200–38,400. No fees. Sysop: Justin Case. [Exp. #101.]

818

20th Century BBS. (818)305-8300. 8-N-1, 24 hrs., 300/1200/2400. Multiline, chat, email, SIGs, databases, new user help. Sysop: Steve Aranyi. [Exp. #102.]

African American BBS! (818)793-9155. P-Funk online, sports, issues, health, business. Check it out. Free. Sysop: Jeffery Mitchell. [Exp. #103.]

Americom. (818)967-3108. 8-N-1, 10 pm–8 am, 300/1200/2400. Laserdisc! Video, photo, file prod., HAM, SWL, Scan. An Arts/Communications BBS. [Exp. #101.]

Aussie BBS. (818)337-9701. 8-N-1. 10 lines, chat, games, high-quality adult GIFs, 18,000 files. Sysop: Mike Szabados. [Exp. #102.]

AutoComp Computer Classifieds. (818)767-8087. 24 hrs. A complete classified BBS. Enter your ads, be sure to check personal ads section. Free access. Sysop: J. Macoy. [Exp. #101.]

Bad-Boy's BBS. (818)946-9304. 24 hrs., 2400/9600/14,400. Fido 1:102/851.6. No fees. Sysop: Brandon L. Heess. [Exp. #101.]

BBB-BBS. (818)982-7529. 2400/9600. Multiline chat, online games, netmail, large files section, GIFs, and shareware. Sysop: Mike Sobetzko. [Exp. #101.]

Blasin' Bytes BBS. (818)776-2784. 1200/2400. 16 lines, unique, fun, full service. Z modem batch D/L, free voice mail. Sysop: Barbara Mallut. [Exp. #102.]

The Board. (818)366-8874. 8-N-1, 300/1200/2400. Email, shareware, job opportunities listed. Free access. Sysop: Ed Jeffers. [Exp. #101.]

Chatterbox! BBS. (818)995-6959. 8-N-1, 24 hrs., 2400/9600. All adult, GIFs, shareware, freeware, multiline chat, library, games, and CD-ROMs. Sysop: Don Adler. [Exp. #102.]

The Drawing Board. (818)965-6241. 8-N-1, 24 hrs., 1200/2400/9600. DTP, graphics, messages, and PD file sections. Sysop: Char Rice. [Exp. #101.]

Eclipse Systems Network. (818)848-1714. 300/1200/2400. Two lines, adult material, GIFs, games. Sysop: Tony Baron. [Exp. #101.]

Hoptips BBS, Glendale. (818)248-3088. 122/9600/14,400. 5 lines serving the needs of the professional; extensive coverage of the office environment; 1-2-3 and WordPerfect conferences. RIME network. Sysop: Mike Callaghan. [Exp. #101.]

INFOmania BBS. (818)791-8680. 8-N-1, 24 hrs., 300–14,400. Fidonet, Racenet, and Business-net conferences, DOS utilities. Free access on first call. [Exp. #103.]

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Panasia BBS. (818)569-3740. 1200–14,400. Glendale, QWK/REP, Intelac RegHub, no fees. [Exp. #103.]

Parthenon BBS. (818)727-7070. 24 hrs., 300/1200/2400/9600/14,400. Utils, Windows, Toshiba stuff, Usenet feeds. Sysop: Steven Foster. [Exp. #103.]

Showtime BBS. (818)285-3185. 1200/2400/9600. Files, graphics, games. Hobbyists welcome. [Exp. #102.]

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Tin Shack BBS. (818)992-3321. Over 1GB of free downloads, immediate access, multiline. Sysop: Guy Nohrenberg. [Exp. #101.]

Tri-City Apple BBS. (818)288-6540. 8-N-1, 24 hrs., 2400. Mostly Apple II, email, PD, UL/DL. [Exp. #101.]

Valley Apple Computer BBS. (818)782-6471. 300/1200/2400. Friendly to beginners, uploading and downloading Apple II only. [Exp. #106.]

Valley Village BBS! (818)763-8160. 8-N-1, 24 hrs., 1200/2400/9600. Multiline chat, online games, doors, mail, 20,000+ files. Sysop: Dan Praeger. [Exp. #103.]

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Video ViSion BBS. (916)682-1655. 24 hrs., 300/1200/2400/9600. Games, graphics, Windows & source code. 360MB. Sysop: Roel Sarceno. [Exp. #101.]

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AOS—Avatar Online Systems. (213)888-2362, (714)524-8996, (818)969-8BBS. 8-N-1. 32 lines, chat, games, tutors, etc. Free trial, 10% discount when referring to *MicroTimes* on application. Sysop: Nancy J. Teppler. [Exp. #101.]

Entertainment & Consumers Network. (310)204-6007, (818)784-3039. 8-N-1, 24 hrs., 300/1200/2400. Your gateway to the global online community of fascinating people. [Exp. #103.]

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Lynzie's Motherboard. (213)848-2700, (714)776-4198, (805)482-5776, (818)989-3875. 8-N-1, 24 hrs., 300/1200/2400. 32 lines, multiuser/group & private chats, 2GB, email, public forums, library, and matching. More local numbers available online. Sysop: Lynzie Flynn. [Exp. #103.]

Modem Butterfly. (213)264-6900, (310)841-6900, 329-7800, (805)581-0700, (818)842-6900, 798-9900. 8-N-1, 1200/2400. 32 lines, CB mode conf, 700MB, SIGs, parties. Free trial. [Exp. #103.]

Original Apple Corps BBS. (213)454-4660, (310)454-4660. 300/1200/2400. Apple II support. Free. Sysop: Sheila Dowst. [Exp. #101.]

The Royal Rook II. (213)934-5749, (818)782-3664. 8-N-1, 24 hrs., 1200/2400. Musicians support board, SIGs, email, teleconferencing. First month free. Sysop: LaJenna Clark. [Exp. #103.]

ASSOCIATIONS

Data Processing Management Association. Meetings: 2nd Thurs., 7:00 pm. An organization composed of all levels of management personnel who have an interest in the field of information processing. Call: (310)549-9680 or (213)225-9210. [Exp. #102.]

Independent Computer Consultants Association, Los Angeles Chapter. Meetings: 1st Thurs., 6:00 pm. Prepaid reservation, $25, or at the door, $35. The LA chapter provides referral services. Call: (213)872-1811. [Exp. #104.]

Microcomputer Managers Association, Los Angeles Chapter. A forum for the discussion of issues relating to implementing and supporting microcomputer technology. Call: (213)243-6843. [Exp. #103.]

Orange County Association Of PICK Professionals. Meetings: 3rd Wed., 6:00 pm, Claim Jumper Restaurant, 18350 Brookhurst St., Fountain Valley. Dinner: Members, $20; nonmembers, $25. Without reservations add $5 additional. Call: (714)641-6347. [Exp. #102.]

The Software Council Of Southern California (SCSC). Non-profit organization for software developers to have a (peer-to-peer) networking and educational forum on industry issues. Call: (310)328-0043. [Exp. #104.]

USER GROUPS

ACCOUNTING

L.A. County Cougar Mountain Accounting Software User Group. Call: (818)788-2627. [Exp. #101.]

ADAM

Inland Empire Adam User Group. Meetings: 3rd Sat., 12:30 pm, Anaheim Public Library, 1340 S. Euclid. Since 1986, LA and Orange Counties' only group and newsletter for the Coleco Adam. Call: Tom, (714)538-6254. [Exp. #105.]

AMIGA

LAAUG—Los Angeles Amiga User Group. Meetings: 3rd Wed., 7:30 pm, Veteran's Memorial Auditorium, Overland Ave. & Culver Blvd. Many SIGs, rookies, monthly PD disks. Call: Kip Hammond, (310)390-3010. [Exp. #105.]

San Fernando Valley Amiga User Group. Meetings: 2nd Tues., 7:00 pm, Meeting Room, Fallbrook Mall. Call: Tony, (818)985-0476. [Exp. #103.]

SBAD—South Bay Amiga Dudes/Dudettes. Meetings: 1st Thurs., 7:00 pm, South Bay Contemporary Museum of Art, Torrance. Call: Gordon Barbay, (310)376-7329. [Exp. #101.]

South Orange Commodore Klub—SOCK. Meetings: 3rd Sat., 9:00 am, Computer Guild, Suite 1003, 24001 Via Fabricante, Mission Viejo. New Location. Supports Commodore and Amiga, new users SIG. Call: Don, (714)830-2430. [Exp. #102.]

APPLE

Orange Apple Computer Club. Meetings: 1st Sat., 9:00 am, Orange Coast College, Chemistry Lab. Apple II supported. Call: (714)731-9243. [Exp. #104.]

Original Apple Corps, Apple II User Group. Meetings: 2nd Sun. Support for beginners through experts. Write: PO Box 90065, Los Angeles, CA 90009. Call: Fred Duffy, (310)475-8400. BBS: (310)454-4660. [Exp. #104.]

Tri-City Apple Users Group. Meetings: 3rd Thurs., 7:00 pm, Pasadena Central Library, 285 E. Walnut St. Friendly Apple II experts. Call: (213)258-0281. [Exp. #106.]

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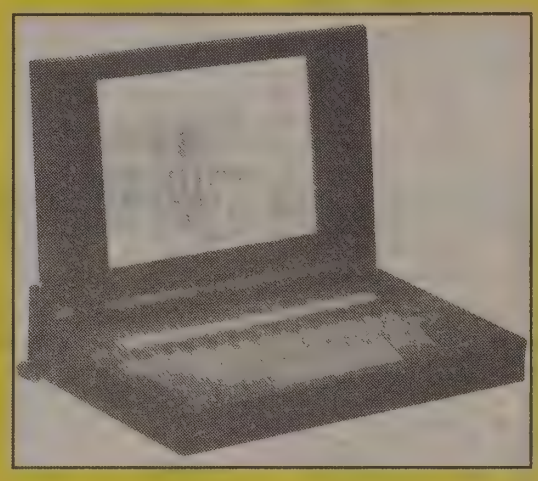

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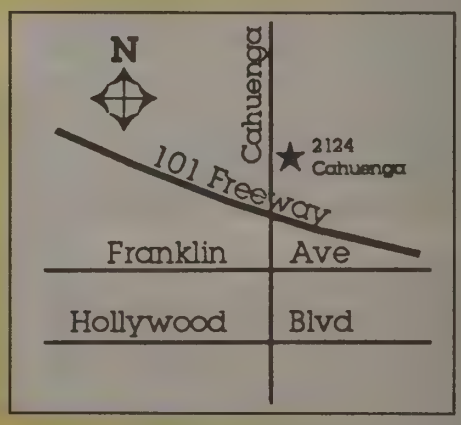

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ATARI

ATESIG—Atari 8-bit SIG. Meetings: 145 Surf Pl., Seal Beach. Cooperative user group for Model Railroad applications. Call: (310)430-5433. [Exp. #106.]

RAM Atari ST User Group Of Ventura County. Meetings: 3rd Wed., 7:30 pm, Call: Tim, (805)389-0059 or write PO Box 112, Camarillo, CA 93011. [Exp. #102.]

South Bay Atari Computer Enthusiasts. Meetings: 2nd Tues., 7:30 pm, Lomita VFW Hall, 1865 W. Lomita Blvd. Active since 1985, novices & all skills welcome. Call: (310)375-4839. [Exp. #102.]

CAD/CAM

Los Angeles Area AutoCAD User Group. Meetings: 4th Wed., 6:30 pm, Burbank Board of Realtor's Bldg., 2006 W. Magnolia Blvd., Burbank. Meetings feature tutorials, Q&As, demos, hands-on, BBS, and newsletter. Call: M. Berman, (818)762-9966. [Exp. #102.]

COMMODORE

C128 West Commodore 128 User Group. Meetings: Covina & Santa Monica. Free membership. Large disk library. Call: John, (818)331-1589; Paul, (818)892-3859; BBS, (714)598-1755 FidoNet. [Exp. #101.]

C-TUG (Commodore Technical User Group). Meetings: Western Federal Savings And Loan, 2233 N. Tustin Ave., Orange. Speakers, demos, help with any Commodore and Amiga questions. Call: Lou Palush, (714)532-1802. [Exp. #104.]

Commodore Helpers Of Long Beach. Meetings: 2nd Sat., 9:00 am. St. Timothy's Lutheran Church, Woodruff and Arbor in Lakewood. Supports 64/128 models. Call: Tom Hoy, (310)424-0508. [Exp. #101.]

Orange County Commodore Club. Meetings: 4th Sat. Orange County Public Library, Park Ave. Branch, 1855 Park Ave., Costa Mesa. Call: Mike Moore, (714)668-9715. [Exp. #105.]

South Bay Commodore Users Group. Meetings: 3rd Thurs, 7:00 pm. SEC Redondo Generating Station, 1100 Harbor Dr. (across from King Yacht Harbor). Free and open to all who use or own Commodore computers and to those who would like to receive or exchange information on programs, applications, or hardware. Call: (310)324-8357. [Exp. #102.]

CORELDRAW

Association Of Corel Artists & Designers, LA Chapter. Meetings: Next to last Tues., 7:00 pm, Glendale Federal Bank Building, 401 N. Brand Blvd. An international nonprofit user group network for anyone using or interested in CorelDraw. Call: (310)452-5637. [Exp. #102.]

DESKTOP PUBLISHING

Southern California Ventura Publisher User Group (SC-VPUG). Meetings: Last Tues., 7:00 pm, 401 N. Brand, Glendale, Glendale Federal Bank Building. Product demos, Q&As, library resources. Call: (818)955-5830. [Exp. #101.]

IBM & COMPATIBLES

Long Beach IBM PC And Compatibles User Group. Meetings: 3rd Wed, 7:00 pm, Los Altos Methodist Church, 5950 E. Willow St., Long Beach. Call: Jim Wells, (310)439-7114. [Exp. #105.]

Los Angeles Computer Society. Meetings: 2nd Tues., 7:00 pm, Culver City High School Cafeteria. Meetings are free and there are always live presentations and giveaways. Call: (310)473-6668. [Exp. #104.]

NOCCC Business & Spreadsheets SIG. Meetings: 1st Sun., 11:00 am, Chapman College, City of Orange. One of 22 SIGs. Call: (714)998-8080. BBS: (714)962-1857. [Exp. #103.]

Orange Coast IBM PC User Group. Meetings: Last Sat., 9:00 am. Orange Coast College. Speakers, BBS, software library, newsletter, and SIGs. Everyone welcome. Call: (714)843-2048. [Exp. #102.]

Public Domain User Group. 1000s of programs for IBM, CP/M, and Commodore computers. For catalog send SASE to: Zoltan Berbely, Disk & That, 1226 E. 7th St., Los Angeles, 90021. [Exp. #105.]

Thousand Oaks Personal Computer Club (TOPCC). Meetings: 4th Thurs., 6:30 pm, Goebel Senior Adult Center, 1385 E. Janss Rd., Thousand Oaks. Call: (805)496-9699. [Exp. #106.]

Valley Computer Club. Meetings: 1st Wed., 7:00 pm, Burbank Board of Realtor's Bldg., 2006 W. Magnolia, Burbank. BBS, PD library, SIGs, newsletter. All welcome. Call: (818)842-3707 or (213)227-9684. [Exp. #102.]

Ventura PC User Group. Meetings: 3rd Sat., 9:00 am, Poinsettia Pavilion, Canada Larga Rm., 3451 Foothill Rd., Ventura. Guests welcome, no charge for attendance. Call: Kenn Ritza, (805)644-6955. [Exp. #102.]

KAYPRO

West Los Angeles Kaypro User Group/KAYOS Kaypro User Group. Meetings: 4th Mon. of even months, 6:30 pm, El Segundo. Call: Margot, (310)379-8339. [Exp. #101.]

K-MAN

Southern California KnowledgeMan User Group. Meetings: 1st Wed., 7:00 pm, Honda North America, Bldg. 300, 700 Van Ness Ave., Torrance. Call: (213)662-9910. [Exp. #104.]

MACINTOSH

The American Film Institute Mac User Group (AFIMUG). Meetings: 2nd Mon., Apple Lab, AFI, Hollywood. TV, film, and video. Call: Dave Chadderdon, (213)856-7743. [Exp. #103.]

Los Angeles Macintosh Group (LAMG). Meetings: 3rd Thurs., 7:30 pm, Dept. of Water & Power, 111 N. Hope St. So. Cal's largest all-Mac user group meetings, monthly magazine, classes, PD software, and more. Call: (310)278-LAMG. [Exp. #105.]

MacValley User Group. Meetings: 1st Wed., 7:30 pm, Wilkinson Senior Center, 8956 Vanalden, Northridge. Meetings, new product demos, newsletter, PD and shareware software, and more. Membership dues, $30/yr. Visitors welcome. Call: Bob Campbell, (818)784-8666. [Exp. #101.]

Orange Apple Computer Club. Meetings: 1st Sat., 9:00 am, Orange Coast College, Chemistry Lab. Macintosh supported. Call: (714)731-9243. [Exp. #101.]

Original Apple Corps, Macintosh User Group. Meetings: 2nd Sun. Support for beginners through experts. Write: PO Box 90065, Los Angeles, CA 90009. Call: Fred Duffy, (310)475-8400. BBS: (310)454-4660. [Exp. #104.]

San Gabriel Valley Mac Users Group. Meetings: 1st Thurs., 7:30 pm, Pasadena Central Library Auditorium. Call: (213)684-ICON. [Exp. #101.]

South Bay Apple Macintosh User Group. Meetings: Last Wed., 7:30 pm, Pacific Elementary School, 1214 Pacific Ave., Manhattan Beach. Call: (310)644-3315. [Exp. #105.]

West Orange County Macintosh User Group (WOCMUG). Meetings: last Tues., 7:00 pm, F&M Bank, 12535 Seal Beach Blvd., in the Rossmoor Shopping Center. Visitors always welcome! Topics for beginning to advanced users. Call: (310)493-1240. [Exp. #101.]

NETWARE

Kern County NetWare Users Association. Meetings: 3rd Thurs. (no meetings in July, August, and December), 5:45 pm, Occidental Bldg., 1200 Discovery Way, Bakersfield. Call: William Morrison, (805)763-6933. [Exp. #105.]

NeXT

Southern California NeXTSTEP User Group. Meetings: throughout LA County. Call: Mike Mahoney, (310)985-1550 or Bob Desharnais, (213)343-2056. [Exp. #103.]

OS/2

LA OS/2 User Group. Meetings: 3rd Wed., 6:30 pm, IBM, 21041 Burbank Blvd., Woodland Hills. Call: Paul Duncanson, (818)549-8957. [Exp. #105.]

TEXAS INSTRUMENTS

TI/944A Home Computer User Group. Meetings: 2nd Mon., 7:00 pm, Pomona First Federal, 9090 Central Ave., Montclair. Monthly newsletter, demos, and fairware. Call: (714)627-3403. [Exp. #102.]

UGOC. Meetings: 2nd Mon., Fidelity Federal, 13820 Seal Beach Blvd. Call: Stan, (714)892-8218. [Exp. #102.]

THEOS

THEOS User Group. Call: Fred Bellemy, (805)965-0265. [Exp. #105.]

UNIX

UNIX User Association Of Southern California. Meetings: 2nd Mon., 7:00 pm, New Horizons Learnings Center, 1231 E. Dyer Rd., Santa Ana. Call: Vince, (714)556-1220, ext. 126. [Exp. #104.]

VIDEO TOASTER

TUG—Toaster Users Group Of Orange County. Meetings: 3rd Thurs. Call: Bruce, (714)894-1777. [Exp. #102.]

TVN—The Toasted Video Network. Video Toaster Network. Call: James, (714)695-1665. [Exp. #103.]

VIRTUAL REALITY

Virtual Reality Special Interest Group (VRSIG). Meetings: The Electronic Cafe, 1649 18th St., Santa Monica. Call: Dave Blackburn, (310)545-0369. [Exp. #105.]

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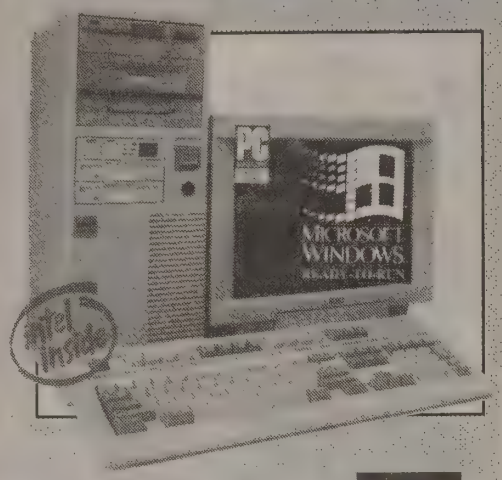

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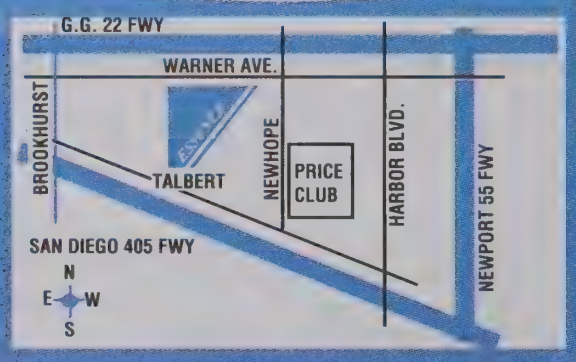

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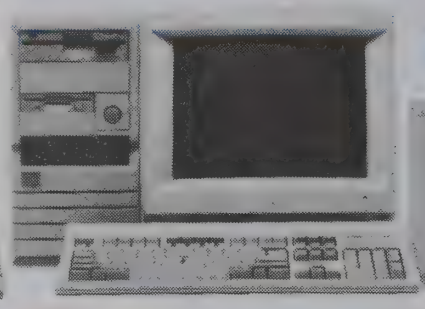

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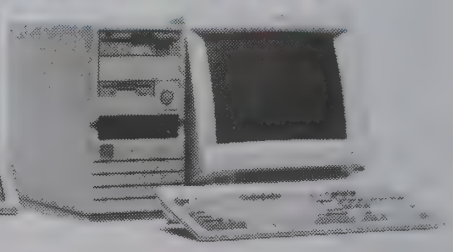

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486DX-50U $1255.00
486DX2-50U $1180.00
486DX-33U $1025.00
486SX-25U $715.00

* UMC 486DX-50/DX2-50/DX-33 M/B
* 256K High speed Cache (64K for 33MHz & 25MHz)
* 4MB Memory on board expandable upto 64MB
* TEAC 1.2M & 1.44M FDD
* 2 Serial / 1 Parallel / 1 Game
* CS-230 Mid-Vertical Case
* 250Watts UL Power Supply
* Focus 2001 Keyboard

386DX-40 ..... $595.00
386DX-33 ..... $590.00
386SX-33 ..... $465.00
386SX-25 ..... $445.00

* 386DX-40/DX-33 M/B
* AMD 80386DX-40/DX-33 CPU
* 64K High speed Cache
* 4MB Memory on board (2MB for 386SX)
* TEAC 1.2M & 1.44M FDD
* 2 Serial / 1 Parallel / 1 Game
* CS-330 Mini-Vertical Case
* 220Watts UL Power Supply
* Focus 2001 Keyboard

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TERMS & CONDITIONS: ALL PARTS AND SYSTEMS CARRY A ONE YEAR LIMITED WARRANTY EXCEPT FOR MONITORS AND PRINTERS WHICH ARE WARRANTED BY MANUFACTURERS. ALL SALES ON MONITORS, PRINTERS AND HARD DISK DRIVES ARE FINAL. NO REFUND. ALL RETURNS ARE SUBJECT TO OUR APPROVAL AND MUST HAVE PRIOR AUTHORIZATION RETURN ITEMS MUST BE IN ITS ORIGINAL CONDITION WITH INVOICE. SEND SHIPPING PREPAID. ALL REFUNDS OR CREDITS ARE LESS SHIPPING AND BANK CHARGES. ALL REFUND ITEMS MUST BE RETURNED WITHIN 14 DAYS OF INVOICE. THERE WILL BE A 20% RESTOCKING FEE AFTER THE 14 DAY PERIOD AND WITHIN 30 DAYS OF INVOICE. THEREAFTER ONLY EXCHANGES ARE AVAILABLE WITHIN 3 MONTHS AND REPAIR FOR THE REST THE WARRANTY PERIOD. PRICE, SPECIFICATION AND AVAILABILITY SUBJECT TO CHANGE WITHOUT ANY NOTICE. ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE. *NO SURCHARGE ON CREDIT CARD PURCHASE* PEAK ADVERTISING CREATIONS ESS MT 10/1/92

We have the perfect system for you!

like the Essence/Orchid combination deserves serious consideration. COMPUTER SHOPPER, July 1992

ESSENCE 486-33DLC

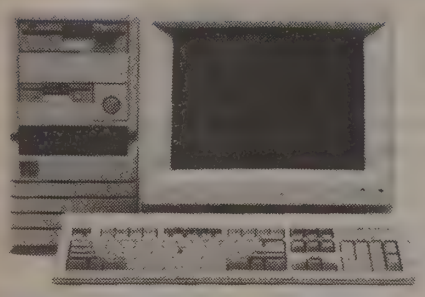
486-33DLC $745.00

*UMC 486-33MHz Main Board
*Cyrix 486-33DLC Microprocessor
*4MB Memory
*Expandable to 8MB/16MB/32MB
*64K High speed Cache
*TEAC 1.2M & 1.44M FDD
*2 Serial / 1 Parallel / 1 Game
*CS-330 Mini-Vertical Case
*220 Watts UL Power Supply
*Foucs 2001 Keyboard

EISA LOCAL BUS

486DX-66 ..... $2125.00
486DX-50 ..... $1815.00
486DX-33 ..... $1570.00

*OPTI 486DX-66/DX-50/DX-33M/B
*256K High speed Cache
*4MB Memory on board expandable up to 32MB
*TEAC 1.2M & 1.44M FDD
*32 Bit DTC2290 EISA IDE Controller
*(Optional IDE Caching controller w/2MB +$155)
*32 Bit Orchid IIs-E 1MB EISA VGA Card
*(S3 1MB Local Bus Graphics Accelerator +$90)
*2 Serail / 1 Parallel / 1 Game
*CS-230 Mide-Vertical Case
*250 Watts UL Power Supply
*Focus 2001 Keyboard



EISA 486DX-66 ..... $2175.00
EISA 486DX-50VE . $1865.00
EISA 486DX-33VE . $1665.00

*VEGA 486DX-66/DX-50/DX-33 M/B
* 256K High speed Cache
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* TEAC 1.2M & 1.44M FDD
* 32Bit DTC2290 EISA IDE Controller
* 32Bit Orchid IIs-E 1MB EISA VGA Card
* 2 Serial / 1 Parallel / 1 Game
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486DX-66V $1625.00
486DX-50V $1325.00
486DX2-50V ... $1215.00
486DX-33V $1080.00
486SX-25V $755.00

*VEGA 486DX-66/DX-50/DX2-50/DX-33 M/B
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* 4MB Memory on board expandable upto 64MB
* TEAC 1.2M & 1.44M FDD
* 2 Serial / 1 Parallel / 1 Game
* CS-230 Mid-Vertical Case
* 250Watts UL Power Supply
* Focus 2001 Keyboard

Promise Super IDE Caching Controller

$195

Multimedia Package

Media Vision Pro Audio Spectrum 16 upgrade kit with Super Fast SCSI CD-ROM drive (290ms Pro Dynamic card with MIDI Interface, Compton's Encyclopedia CD-Rom, Windows 3.1 CD-Rom and more...

$925

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For EISA & Local Bus Systems:

ViewSonic 6E 14" Non-Interlaced Monitor $332.00
ViewSonic 5E 14" Non-Interlaced Monitor $410.00
ViewSonic 6FS 15" Non-Interlaced Monitor $605.00
ViewSonic 7 17" Multi-Frequency Monitor $1050.00
ViewSonic 8 20" Multi-Frequency Monitor $1605.00

For ISA Systems:

12" Monochrome Monitor w/MonoGraphics Card $102.00
14" Monochrome Monitor w/MonoGraphics Card $120.00
14" MonoVGA (Paper-white) Monitor w/AVGA Card (256K) $159.00
14" AcerView 11 VGA Color Monitor (.39dp) w/16-bit VGA Card (256K) $265.00
14" AcerView 33D SuperVGA Color Monitor (.28dp) w/TVGA-8900C 1MB VGA Card $350.00
14" AcerView 34T Non-Interlaced Color Monitor (.28dp) w/TVGA-8900C 1MB VGA Card $390.00
14" ViewSonic 6E Non-Interlaced Color Monitor (.28dp) w/TVGA-8900C 1MB VGA Card $395.00
14" ViewSonic 5E Non-Interlaced Color Monitor (.28dp) w/TVGA-8900C 1MB VGA Card $474.00
w/Orchid ProDesigner IIs 1MB Hi-Color VGA Card $545.00
15" ViewSonic 6FS Digital Auto-Tracking Flat-Screen Monitor (.28dp) w/Orchid Fahrenheit 1280 1MB Graphics Accelerator $795.00
w/Orchid Fahrenheit VA Graphics Accelerator w/Voice Annotation $825.00
17" ViewSonic 7 Digital Auto-Tracking Monitor (.28dp) w/Orchid Fahrenheit 1280 1MB Graphics Accelerator $1240.00
w/Orchid Fahrenheit VA Graphics Accelerator w/Voice Annotation $1270.00
w/ATi Graphics Ultra (1MB) $1335.00

Hard Disk Subsystem & Other Options (w/Systems):

40MB IDE HDD $180.00
80MB IDE HDD $225.00
120MB IDE HDD $298.00
170MB IDE HDD $335.00
200MB IDE HDD $380.00
340MB IDE HDD $698.00
520MB IDE HDD $895.00
MicroSoft DOS 5.0 ..... $37.00
MicroSoft Windows 3.1 w/Mouse $55.00
Internal 2400Buad Data Modem $35.00
Internal 9600/2400 Baud Fax/Data Modem $65.00
Sound Blaster $95.00
Sound Blaster Pro $189.00
Media-Vision Pro Audio Spectrum 16 Sound Card $195.00

Tape Backup:

Colorado DJ-10 120MB $198.00
Colorado DJ-20 250MB $255.00

Memory Upgrade:

4MB (386SX) $68.00
8MB (486DX/SX,386DX) $150.00
16MB (486DX/SX,386DX) $415.00

For GREAT Pricing on Peripherals, *See Next Page* ➡

SYSTEM BOARDS (0K)

EISA Bus & Local Bus System Boards (w/CPU)

- Orchid SuperBoard 486DX-50MHz Local Bus M/B w/256K Cache ... $920.00
- Orchid SuperBoard 486DX-33MHz Local Bus M/B w/256K Cache ... $725.00
- Orchid Pro-Designer IIs-D 1MB 32-bit Local Bus VGA Card ... $175.00
- Orchid Fahrenheit 1280-D 1MB 32-bit Local Bus Accelerator ... $225.00
- OPTI Baby 486DX2-66MHz EISA Local Bus M/B w/256K Cache ... $1275.00
- OPTI Baby 486DX-50MHz EISA Local Bus M/B w/256K Cache ... $975.00
- OPTI Baby 486DX-33MHz EISA Local Bus M/B w/256K Cache ... $805.00
- OPTI Baby 486DX-50MHz Local Bus M/B w/256K Cache ... $785.00
- OPTI Baby 486DX-33MHz Local Bus M/B w/256K Cache ... $595.00
- ET-4000 1MB Local Bus VGA Card (33 & 50 MHz) ... $125.00
- ET-4000 1MB Local Bus VGA Card w/IDE Multi IO (33 & 50 MHz) ... $150.00
- S3 1MB Local Bus Graphics Accelerator (33MHz) ... $225.00
- S3 1MB Local Bus Graphics Accelerator w/IDE Multi IO (33MHz) ... $250.00
- S3 1MB Local Bus Graphics Accelerator (50MHz) ... $255.00
- S3 1MB Local Bus Graphics Accelerator w/IDE Multi IO (50MHz) ... $280.00
- 32-bit Local Bus IDE Caching Controller w/2MB (upto 16MB) ... $245.00
- VEGA Baby 486DX2-66MHz EISA M/B w/256K Cache (USA made) ... $1350.00
- VEGA Baby 486DX-50MHz EISA M/B w/256K Cache (USA made) ... $1050.00
- VEGA Baby 486DX-33MHz EISA M/B w/256K Cache (USA made) ... $880.00

ISA Bus System Boards (w/CPU)

- VEGA Baby 486DX2-66MHz M/B w/256K Cache (USA made) ... $1130.00
- VEGA Baby 486DX-50MHz M/B w/256K Cache (USA made) ... $830.00
- VEGA Baby 486DX2-50MHz M/B w/256K Cache (USA made) ... $730.00
- VEGA Baby 486DX-33MHz M/B w/64K Cache (USA made) ... $615.00
- VEGA Baby 486SX-25MHz M/B w/64K Cache (USA made) ... $320.00
- VEGA Baby 3-486DX-40MHz M/B w/256K Cache (USA made) ... $300.00
- UMC Baby 486DX-50MHz M/B w/256K Cache (Write-back cache) ... $770.00
- UMC Baby 486DX2-50MHz M/B w/256K Cache (Write-back cache) ... $695.00
- UMC Baby 486DX-33MHz M/B w/64K Cache (Write-back cache) ... $565.00
- UMC Baby 486SX-25MHz M/B w/64K Cache (Write-back cache) ... $275.00
- OPTI Mini 486DX-50MHz M/B w/256K Cache (Write-back cahe) ... $750.00
- OPTI Mini 486DX2-50MHz M/B w/256K Cache (Write-back cache) ... $675.00
- OPTI Mini 486DX-33MHz M/B w/64K Cache (Write-back cache) ... $545.00
- OPTI Mini 486SX-25MHz M/B w/64K Cache (Write-back cache) ... $255.00
- Symphony Mini 486DX-50MHz M/B w/256K Cache ... $760.00
- Symphony Mini 486DX-33MHz M/B w/64K Cache ... $555.00
- UMC Mini 486-33DLC M/B w/64K Cache (Cyrix 486-33DLC CPU) ... $350.00
- OPTI Baby 386DX-40MHz M/B w/64K Cache (Write-back cache) ... $198.00
- OPTI Mini 386DX-40MHz M/B w/64K Cache (Write-back cache) ... $190.00
- UMC Mini 386DX-40MHz M/B w/64K Cache (Write-back cache) ... $190.00
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- OPTI Mini 386DX-33MHz M/B w/64K Cache (w/AMD CPU) ... $184.00
- UMC Mini 386DX-33MHz M/B w/64K Cache (w/AMD CPU) ... $188.00
- C & T Baby 386DX-33MHz M/B w/64K Cache (w/AMD CPU) ... $217.00
- **** 256K Cache upgrade for all 486 and 386 M/B* ... *$45.00*
- OPTI Baby 386DX-25MHz M/B (w/AMD CPU) ... $160.00
- OPTI Mini 386SX-33MHz M/B ... $140.00
- C & T Mini 386SX-25MHz M/B ... $128.00

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- Mono/Graphics/Printer Card ... $15.00
- AVGA-1 VGA Card w/256K ... $28.00
- TVGA-9000 VGA Card w/256K (Trident 9000 Chipset,upto 512K) ... $37.00
- TVGA-8900C 1MB SuperVGA Card (Trident 8900C Chipset) ... $64.00
- PVGA-1C VGA Card w/256K (WD90C11 Chipset,upto 512K) ... $49.00
- PVGA-1D SuperVGA Card w/1MB (WD90C30 Chipset) ... $78.00
- PVGA-1DW Graphics Accelerator w/1MB & Hi-Color Chip ... $125.00
- ATi VGA Wonder XL VGA Card (32,768colors,OEM Version) ... $125.00
- ATi Graphics Ultra 1MB (VRam) VGA Card w/o Mouse (OEM package)
  - 24 times faster than SuperVGA cards, 1280x1024 ... $272.00
- ATi Graphics Ultra 1MB (VRam) VGA Card w/Mouse (OEM package)
  - 24 times faster than SuperVGA cards, 1280x1024 ... $286.00
- ATi Ultra Plus (1280x1024, 1MB Dram, upto 2MB) ... Call
- Ati Ultra Pro (1280x1024 Non-Interlaced, 1MB VRam, upto 2MB) ... Call
- Diamond SpeedStar-24X 1MB VGA Card (16Million colors) ... $190.00
- Diamond Stealth 1MB (VRam) Windows Accelerator ... $230.00
- Orchid Pro-Designer IIs 1MB VGA Card w/Sierra RAMDAC
  - 70Hz refresh rate @1024x768 ... $145.00
- Orchid Pro-Designer IIs-E 1MB EISA VGA Card w/Sierra RAMDAC
  - 70Hz refresh rate @1024x768 ... $175.00
- Orchid Fahrenheit 1280-24 1MB (VRam) Graphics Accelerator (24-bit)
  - 16.7Mil colors, 1280x1024 ... Call
- Orchid Fahrenheit VA Windows Accelerator with Voice Annotation
  - 16.7Million colors, 1280x1024, Audio capabilities ... Call

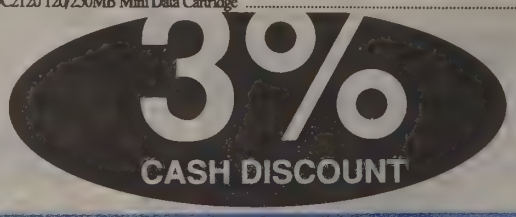
- AT I/O (2 Serial 1 Parallel 1 Game) Card ... $14.00
- Parallel (Printer) Card ... $10.00
- Game Card (Dual ports) ... $10.00
- AT IDE Adapter (Dual floppy & hard disk) w/Cable ... $15.00
- AT IDE Adapter w/2.88M FDD Controller & Cable ... $57.00
- AT Super IDE IO Adapter (Dual floppy & hard disk, 2S, 1P, 1G) ... $22.00
- GSI 2.88M Four (4) Floppy Controller & Cable ... $68.00
- GSI 2.88M Four (4) Floppy & IDE Adapter w/Cable ... $82.00
- Promise IDE Caching Controller (512K,upto 8.5MB,2FD/2HD) ... $140.00
- DTC-2290 EISA IDE Floppy/Hard Disk Contoroller ... $138.00
- DTC-3290 EISA SCSI Caching FD/HD Controller (0K,upto 4MB) ... $380.00
- UltraStor 12F-24 1:1 (24MBit/s) ESDI Floppy/Hard Disk Controller ... $155.00
- UltraStor 15C IDE Caching FD/HD Controller w/0MB (upto 8MB) ... $195.00
- UltraStor 14F SCSI FD/HD Controller ... $230.00
- UltraStor 24F EISA SCSI FD/HD Controller ... $375.00
- Future Domain 1670 16-bit SCSI Floppy/Hard Disk Adapter Kit ... $158.00
- Always IN-2000 16-bit SCSI Host Adapter (Novell Certified) ... $198.00
- ADAPTEC AHA-1522BK SCSI Adapter Kit ... $160.00
- ADAPTEC AHA-1542BK SCSI Bus Master Host Adapter Kit ... $265.00
- ADAPTEC AHA-1740BK EISA SCSI Bus Master Adapter Kit (No FDC) ... $465.00
- ADAPTEC AHA-1742BK EISA SCSI Bus Master Adapter Kit ... $485.00

MONITORS

- AcerView 11 14" VGA Monitor (640x480,.39dp) ... $238.00
- AcerView 33D 14" SuperVGA Color Monitor (1024x768,.28dp) ... $288.00
- AcerView 34T 14" Non-Interlaced Monitor (1024x768,.28dp) ... $330.00
- AcerView 35 14" SuperVGA Monitor (1024x768,.26dp) ... $460.00
- CTX5439A 14" SuperVGA Color Monitor (1024x768,.39dp) ... $245.00
- CTX5468A 14" SuperVGA (TriScan) Color Monitor (1024x768,.28dp) ... $285.00
- CTX5468NI 14" Non-Interlaced Color Monitor (1024x768,.28dp) ... $318.00
- MAG MX-15H 15" Color Monitor (1280x1024,.28dp) ... $615.00
- MAG MX-17H 17" Color Monitor (1280x1024,.28dp) ... $1150.00
- NEC MultiSync 3FGx 15" Color Monitor (1024x768,.28dp) ... $670.00
- NEC MultiSync 4FG 15" Color Monitor (AccuColor & Digital Controls 1024x768,.28dp) ... $775.00
- NEC MultiSync 5FG 17" Color Monitor (AccuColor & Digital Controls 1280x1024,.28dp) ... $1450.00
- NEC MultiSync 6FG 21" Color Monitor (AccuColor & Digital Controls 1280x1024,.28dp) ... $2460.00
- Sony CPD-1304S 14" MultiScan Monitor (Non-Interlaced,.25dp) ... $598.00
- Sony CPD-1604S 17" MultiScan Monitor (Non-Interlaced,.25dp) ... $1050.00
- Mini-Micro MM1256A 12" Amber Monitor ... $86.00
- Mini-Micro MM1457A 14" Amber Monitor ... $104.00
- Mini-Micro MM1457W 14" Paper-white Monitor ... $106.00
- Mini-Micro MM1467L 14" Paper-white MonoVGA Monitor ... $126.00
- Mini-Micro MM1468 14" VGA Color Monitor (640x480,.41dp) ... $240.00
- Mini-Micro MM1477 15" VGA Color Monitor (1024x768) ... $445.00
- ViewSonic 4E 14" SuperVGA Color Monitor (1024x768,.28dp) ... $305.00
- ViewSonic 6 14" Non-Interlaced Color Monitor (1024x768,.28dp) ... $340.00
- ViewSonic 6E 14" Non-Interlaced Color Monitor (1024x768,.28dp) ... $332.00
- Viewsonic 5E 14" Non-Interlaced Color Monitor (1024x768,.28dp 72Hz refresh rate @1024x768) ... $410.00
- ViewSonic 5+ 14" Non-Interlaced Color Monitor (1024x768,.25dp Trinitron tube, 70Hz refresh rate @1024x768) ... $515.00
- ViewSonic 6PS 15" Multi-Frequency Color Monitor (Flat-Screen, Low radiation, 1280x1024,.28dp, 72Hz refresh rate @1024x768) ... $605.00
- ViewSonic 7 17" Multi-Frequency Color Monitor (Digital Auto-Tracking Flat-Screen, Low radiation, 1280x1024,.28dp) ... $1050.00
- ViewSonic 8 20" Multi-Frequency Color Monitor (Digital Auto-Tracking Low radiation, 1280x1024,.31dp) ... $1605.00

FLOPPY & HARD DRIVES

- TEAC 1.2MB FDD (5.25") ... $58.00
- TEAC 1.44MB FDD (3.5") w/Mounting Kit ... $55.00
- TEAC 2-in-1 1.2/1.44MB FDD ... $148.00
- TEAC 2.88MB FDD (3.5") w/Mounting Kit ... $90.00
- Panasonic 1.2MB FDD (5.25") ... $58.00
- Panasonic 1.44MB FDD (3.5") w/Mounting Kit ... $55.00
- Conner CP-3000 40MB IDE HDD (29ms) ... $180.00
- Conner CP-30084 80MB IDE HDD (17ms) ... $228.00
- Conner CP-30104 120MB IDE HDD (17ms) ... $298.00
- Conner CP-30174 170MB IDE HDD (17ms) ... $335.00
- Conner CP-30204 210MB IDE HDD (12ms,256K cache buffer) ... $430.00
- Conner CP-3544 520MB IDE HDD (12ms,256K cache buffer) ... $895.00
- Conner CP-3540 520MB SCSI HDD (12ms,256K cache buffer) ... $895.00
- Fujitsu M2624T 520MB IDE HDD (12ms, 5yr warranty) ... $945.00
- Fujitsu M2624FA 520MB SCSI HDD (12ms, 5 yr warranty) ... $1035.00
- Fujitsu M2266SA 1.2GB SCSI HDD (12ms, 5yr warranty) ... $1625.00
- Fujitsu M2652S 2.0GB SCSI HDD (12ms, 5yr warranty) ... $2550.00
- Maxtor MX-7120A 120MB IDE HDD (15ms) ... $305.00
- Maxtor MX-7120S 120MB SCSI HDD (15ms) ... $325.00
- Maxtor MX-7213A 213MB IDE HDD (15ms) ... $395.00
- Maxtor MX-7213S 213MB SCSI HDD (15ms) ... $525.00
- Maxtor LXT-340A 340MB IDE HDD (13ms) ... $715.00
- Maxtor LXT-340S 340MB SCSI HDD (13ms) ... $715.00
- Maxtor LXT-535A 520MB IDE HDD (13ms) ... $895.00
- Maxtor LXT-535S 520MB SCSI HDD (13ms) ... $905.00
- Maxtor XT-8760S 675MB SCSI HDD (16.5ms) ... $1200.00
- Maxtor PO-12 1.2GB SCSI HDD (13ms) ... $1550.00
- Maxtor P1-17S 1.7GB SCSI HDD (13ms) ... $1775.00
- Micropolis 1598 1.2GB SCSI HDD (14.5ms, 5 yr warranty) ... $1615.00
- Micropolis 1548 1.75GB SCSI HDD (14ms, 5 yr warranty) ... $2250.00
- Quantum LPS12A012 120MB IDE HDD (17ms,256K cache buffer) ... $330.00
- Quantum LPS24A012 240MB IDE HDD (15ms,256K cache buffer) ... $510.00
- Seagate ST-351AX 42MB IDE HDD (28ms) ... $180.00
- Western Digital AC280 80MB IDE HDD (17ms) ... $225.00
- Western Digital AC2120 120MB IDE HDD (15ms) ... $305.00
- Western Digital AC2170 170MB IDE HDD (14ms) ... $335.00
- Western Digital AC2200 209MB IDE HDD (13ms) ... $380.00
- Western Digital AC2340 340MB IDE HDD (13ms) ... $698.00
- SyQuest SQ555 44MB SCSI Removable Disk Drive ... $290.00
- SyQuest SQ5110 88MB SCSI Removable Disk Drive ... $335.00
- SyQuest SQ400 44MB Cartridge ... $75.00
- SyQuest SQ800 88MB Cartridge ... $108.00
- SyQuest SQ01 SCSI Adapter w/Software ... $45.00
- SyQuest External Kit ... $115.00
- Colorado Memory System JT-10 120MB Parallel Port Tape Backup ... $410.00
- Colorado Memory System JT-20 250MB Parallel Port Tape Backup ... $450.00
- Colorado Memory System DJ-10 120MB Tape Backup ... $205.00
- Colorado Memory System DJ-20 250MB Tape Backup ... $260.00
- Colorado Memory System AB-11 External Adapter Kit ... $40.00
- Colorado Memory System KE-09 External Drive Kit ... $80.00
- Colorado Memory System FC-10 500Kb/s-1Mb/s Adapter Kit ... $90.00
- Colorado Memory System TC-15 Data Compression Adapter Kit ... $189.00
- 3M DC2120 120/250MB Mini Data Cartridge ... $21.50



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PRINTERS

- Citizen 200GX Printer (9pin/213cps/80col/color option) ... $164.00
- Citizen GSX-140+ Printer (24pin/220cps/80col/color option) ... $295.00
- Citizen GSX-230 Quiet Printer (24pin/color option) ... Call
- Citizen GSX-240 Quiet Printer (24pin/300cps/80col/color option) ... $328.00
- Citizen GSX-145 Printer (24pin/192cps/132col/color option) ... $375.00
- **** Color Kit for Citizen 200GX, GSX-140 +, GSX-230 or GSX-240* ... *+45.00*
- Hewlett Packard DeskJet 500 InkJet Printer ... $415.00
- Hewlett Packard DeskJet 500C Color InkJet Printer ... $725.00
- Hewlett Packard LaserJet IIP Plus Laser Printer ... $815.00
- Hewlett Packard LaserJet IIIP Laser Printer ... $1025.00
- Hewlett Packard LaserJet III Laser Printer ... $1475.00
- Panasonic KX-P1180i Printer (9pin/240cps/80col) ... $159.00
- Panasonic KX-P1123 Printer (24pin/240cps/80col) ... $199.00
- Panasonic KX-P1124i Printer (24pin/300cps/80col) ... $289.00
- Panasonic KX-P1624 Printer (24pin/192cps/132col) ... $364.00
- Panasonic KX-P2180 Quiet Printer (9pin/240cps/80col/color option) ... $178.00
- Panasonic KX-P2123 Quiet Printer (24pin/240cps/80col/color option) ... $248.00
- Panasonic KX-P2124 Quiet Printer (24pin/320cps/80col/color option) ... $328.00
- Panasonic KX-P2624 Quiet Printer (24pin/300cps/132col) ... $398.00
- **** Color Kit for Panasonic KX-P2180, KX-P2123 or KX-P2124* ... *+45.00*
- Panasonic KX-P4410 Laser Printer (5ppm/512K/300dpi) ... $649.00
- Panasonic KX-P4430 Laser Printer (5ppm/1MB/300dpi) ... $915.00
- Okidata OL400P LED Page Printer ... $598.00
- Okidata OL810 LED Page Printer ... $1048.00
- Okidata OL830 LED Page Printer ... $1278.00
- Okidata OL840 Postscript Printer ... $1598.00
- Star NX-1001 Multi-Font Printer (9pin/180cps/80col) ... $139.00
- Star NX-1020R Color Printer (9pin/180cps/80col) ... $179.00
- Star NX-2420R Rainbow Color Priner (24pin/250cps/80col) ... $289.00

KEYBOARDS

- BTC 5339SX 101keys Keyboard ... $25.00
- Focus-2001 101keys Keyboard w/Hard Dustcover (Click) ... $42.00
- Focus-5001 130keys Keyboard (Dble function keys, calculator, etc.) ... $56.00
- Focus-6000 101keys Keyboard (Soft click) ... $36.00
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continued from page 76

wrote down the structure doesn't know any chemistry, and that's enough to block the further study necessary to understand the system context in which the proposal makes sense.

That's one of the more striking cases in my experience. In fact, the specific chemist I have in mind who made that observation was quoted as saying that in an article. I subsequently talked with him and put him on my doctoral committee. [*laughs*] At the end of which, I gather, he decided that I did know some chemistry.

So do you find that as time has progressed, the academic community is more receptive than it was initially? One of the points in *Unbounding* that really struck home was the statement that any new technology is initially going to attract as many flakes and charlatans as reputable practitioners.

And it will do that in particular if it has large consequences. What you're describing is a pattern that also works with scientists—society trusts scientists to judge new technological proposals, rightly or wrongly. [*laughs*] Many scientists, however, judge new proposals based not on how they look when they're examined, but on how they smell culturally. And if a set of proposals has striking, exciting human consequences, it will stir a fuss, and the fuss will create a stink, and the scientists will turn up their noses.

And therefore we have a systematic mechanism which is very good at rejecting nonsense, that also rejects some of the more important things that are sensible. One of the consequences of this mechanism which is good at rejecting nonsense is that some of the most important long-range developments will be systematically scoffed at, for a while.

It's in part a matter of asking the wrong experts. Asking chemists about molecular manufacturing is like asking transistor designers about computer architectures. Organic chemists work with structures that typically have a few to a few hundred atoms. A simple low-end molecular manufacturing system might have a billion atoms. The gap there is comparable to the gap between a single transistor—an isolated transistor and package, the level of technology in the 1950s—and the kind of VLSI that we're only getting toward today.

So, go to the 1950s. Find someone who is working on growing germanium crystals to make the old germanium transistors, and ask that person to judge proposals for ten-million-transistor-on-a-chip computers, and whether RISC or CISC architectures are preferred. You'll get a blank expression, and the notion of having ten million devices on one piece of semiconductor would seem to be a fantasy.

There's also a major cultural gap between the United States and Japan regarding setting goals, articulating goals. Many Japanese research projects are given extremely ambitious goals. For example, the Kunetaki Molecular Architecture Project speaks of self-organizing, intelligent, self-repairing, etc., etc., etc. molecular systems.

That project is over. It was a five-year project. Did they achieve that? No. On the other hand, what they did was, they set the best direction they could think of, very ambitious. A direction that, if achieved, would lead to enormous payoffs. In that project they took steps in that direction, because that was the direction they'd articulated.

If you judge their achievements relative to the end point of the direction they were pointing, they fall short, and you call it a failure. If instead you ask, "Did they direct their resources better because they chose those goals?" I think the answer is yes.

In the United States we are afraid to articulate ambitious long-term goals, for whatever reasons—in part, the tendency of people to come back two years later and say, "You haven't done it yet, and since you couldn't possibly have been planning ten or twenty years in advance, you must have failed."

Because of those sorts of attitudes we don't articulate ambitious long-term goals. As a result, I believe, we tend to put our research efforts into directions that have, on the average, less long-term payoff, because we're not looking.

I'm not saying that we can predict the outcome of research programs, or that we can predict what will pay off in the future. I'm saying that we do better if we try than if we don't. If we try intelligently than if we don't. Otherwise you're throwing away information, soft information, in favor of hard laboratory data on something that may be uninteresting in the long term.

It's safe to assume that for every glorious life-saving application of this technology that might come along, there's almost sure to be an equally sinister and destructive one, perhaps developed in some secret government lab. Is that an accurate perception, and if it is, how can people who are interested in nanotechnology keep it from going off to the dark side before it even gets out of the lab?

That's been a subject of a lot of discussion among people who are really concerned with these issues. The policy that people seem to have settled on as making the most sense is to make it clear that yes, among the applications of this manufacturing technology is the manufacturing of systems that are tremendously subject to abuse, things that are inherently tremendously dangerous.

But it's important to more than balance that by focusing on how these capabilities can be used for medicine, increasing wealth per capita while cleaning up the environment, and a whole range of beneficial applications that would naturally occur in the civilian sector, and would naturally encourage international cooperation.

Because at this point, with all that we know of the potential dangers of technology and all the discussion there has been of this one, the potential nightmare scenario is not that we plunge ahead blindly ignoring the dangers and have them take us by surprise. The nightmare scenario is that a focus on the destructive potential of new technologies leads to them being classified as a military technology, leading to international rivalry with a military flavor, and precipitating a war.

The optimistic scenario is one in which we keep in mind, as has happened so far, the potential for abuse, and the things that would be dangerous if you did them, and consider how we can avoid doing anything like that, while focusing on goals that encourage cooperation. ■

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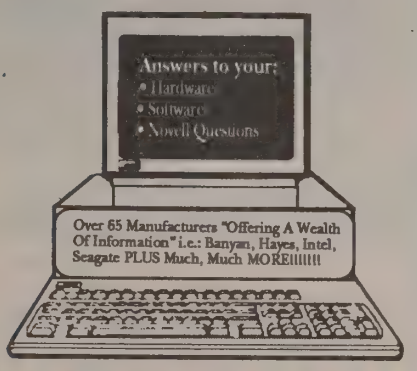
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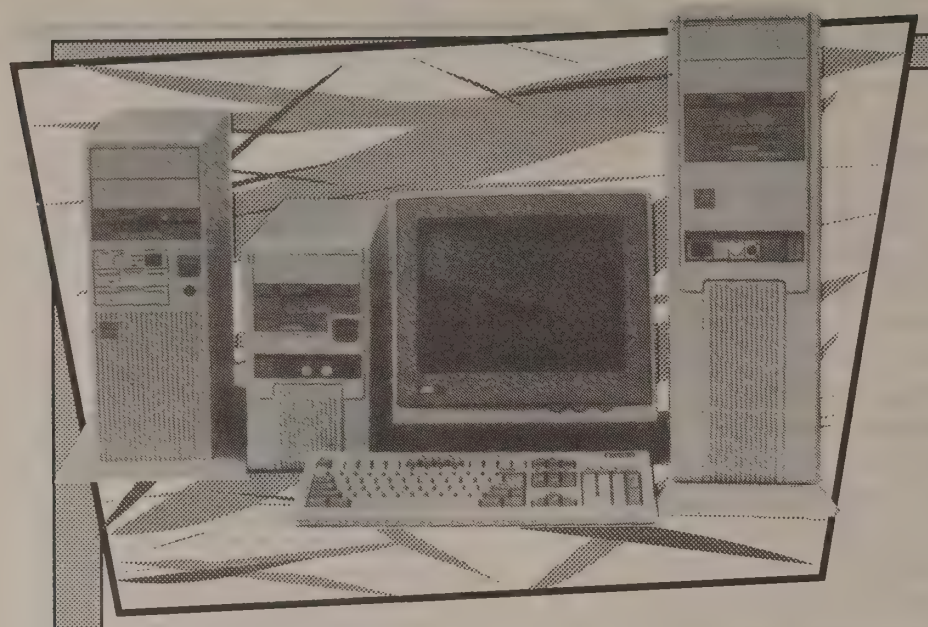

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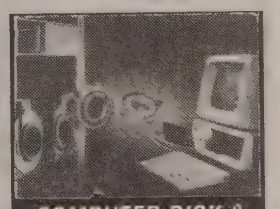

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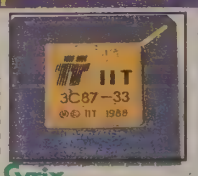

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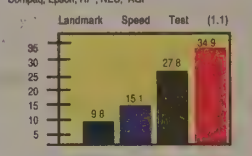

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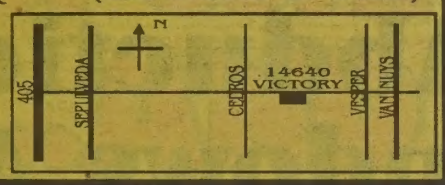

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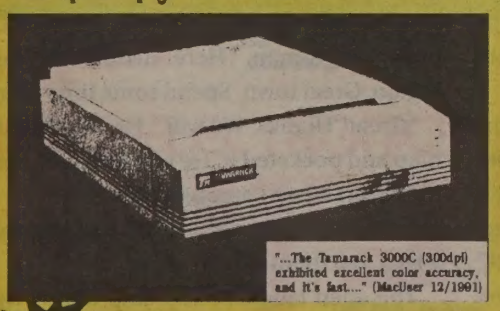

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Aliens, Abductions, Software, Windows, And You

Or Why I Never Get Asked To Speak At UFO Conventions

BY JOHN C. DVORAK

I knew my luck had run out when the little geeks showed up at the front door. You know, those bug-eyed, skinny, weird, alien goofballs who abduct people left and right while the government does nothing, *nothing*!

So I opened the door and was confronted by three of the brownish green, black-eyed bipeds. Unable to talk well in the nitrogen/oxygen air mixture we have here on earth, they instead point and grunt a lot. They grunted as they walked in the front door. I looked outside to see an eerie green light. The cars on the freeway were moving slow, and the two across-the-street neighbors were frozen solid by some sort of ray. Nobody ever sees these aliens except the unfortunate few who are "contacted" by them for one reason or other.

DVORAK'S LAST COLUMN

In no time, we were off in the alien space ship, chatting in the argon/xenon/oxygen air which made their voice boxes function properly. Since most abductions are against the will of the participants, few have reported on the aliens' voices. Just for the record, they all sound like Bing Crosby!

I was rushed into the Captain's quarters, where four bug-eyed aliens were leaning over a 486 clone. The Captain motioned me over.

He pointed at the monitor. "This damned Windows program keeps crashing. We're having nothing but problems. Can you fix it?"

Oh, brother, I thought to myself, Intergalactic Ask Dvorak. "What applications are you running?"

"You know, Lotus, Word Perfect, stuff like that." He shrugged his shoulders.

"Can't you guys write your own applications? Does anyone on this vessel code?"

One of the other aliens spoke up. "We had three crew members who learned to code in C, assembler, and Pascal; they jumped ship to work at Microsoft. They've managed to blend in so well in Washington State that we've been unable to recover them. We may have lost them for good. I understand many coders never leave their offices for days up there."

I was just about to comment when the entire ship shook violently tossing everyone around the room.

A huge viewing screen dropped from the ceiling as things settled down. On it appeared a weird, block-headed, pink-faced alien, the likes of which I'd never seen.

He spoke in a loud, demanding voice. "We have locked on to your ship. You have Dvorak. Send him to us or we will board your ship and destroy you."

The Captain rose to his feet. "Threats mean nothing to us! But you can have Dvorak."

Before I knew it, the other three guys were hustling me into the corridor in a big hurry. There a doorway opened, leading to the other spacecraft. Next thing I knew, I was doing a two-foot slide on a slick, black metallic floor in a large room, sliding to a stop in front of three block-headed, multicolored aliens. Looking like rejects from that screwy razor ad where the guy has a cubic head, the aliens were huddled around a PC clone. The one whose face I saw on the screen spoke first. "We can't get OS/2 installed. It dies for no good reason."

"What the heck machine are you installing it on?"

The guy look depressed. "Golly, Mr. Dvorak, I really don't know."

I realized that I couldn't get too angry with these characters since I'd probably have to get a ride home from them. "Can I ask you if you can get me back to my house in California?"

A short green-colored blockhead popped in front of me. "Do you have to be home this century?" He burst out laughing.

"What?!"

"Don't listen to him. He's a joker," said the pink head. "Is there anything we can do about this gear?"

"Have you guys thought about buying some new stuff? OS/2 requires new equipment, not this old crap. There are a lot of stores in California where you can get this stuff cheap. What are you going to use the machines for?"

"We are going to use them to plan the destruction of Western Civilization on your earth!"

"What? How?"

"By helping to elect a Democratic President and a Democratic Congress!!" His face lit up as the little green guy pounded out a rimshot in the corner where a set of drums mysteriously appeared. They all laughed and a large jack-in-the-box popped out of the PC clone.

They all laughed again. "Cheer up, Dvorak, we just invited you over to tell you we enjoy your writings. There are aliens other than the bug-folk, who get all the publicity. Maybe you could write about us someday.

"And, as for the OS/2 thing. We're Mac users! We were just joking. Hahahaha. Ready to beam back home?"

I was flabbergasted. Just as I was about to say yes, I was struck in the face by a cream pie. I heard laughing in the background just as a buzzing sound began.

Before I knew what was happening I was back in my living room, still covered with pie cream. Somehow my right shoe was balanced on the top of my head. It fell to the floor and I put it on my foot and went to the kitchen to rinse off the goo. I looked out the window, and the ship containing the practical jokers was hovering over my neighbor's house, sending a beam down to sting the neighbor's dog, who jumped around flinching and barking at the vessel.

The blue-faced alien appeared behind me with a little whisk broom and brushed my back. "I'm terribly sorry about our penchant for joking around," he said. "We just do it naturally. We love to disrupt things. It's great fun.

"So where do you recommend we find a good computer store?"

I thought for a moment. "You guys get around pretty fast. Let me get a map and show you the town to look for computers." I pulled out a map. "Here. Redmond, Washington. Great town. Spend some time there."

"Great! Thanks. We will." He rolled up the map and pocketed it. He was about to signal his return when I stopped him.

"Oh, and if you see a couple of bug-eyed aliens, tell them to call home."

The alien laughed. The ship left. A week later I heard Windows NT was delayed and three programmers had left. ■

© 1992 by John C. Dvorak. All rights reserved. *John C. Dvorak graduated from the University of California. He is a contributing editor of* PC Magazine *and* MacUser, *and is considered by many to epitomize the contrarian view of things—a charge that he vehemently denies. Dvorak's motto is: If you have nothing nice to say, then don't say anything at all.*

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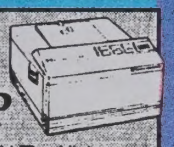

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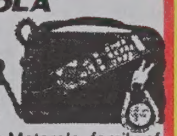

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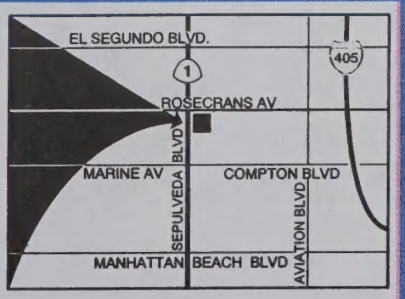

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